PROJECT MANUAL

Backup Power Equipment Replacement

Fulton Reception and Diagnostic Center

Fulton, Missouri

Designed By: Henderson Engineers, Inc.
8345 Lenexa Dr.
Lenexa, KS 66214

Date Issued: September 26, 2025

Project No.: C2415-01

STATE *of* MISSOURI

OFFICE *of* ADMINISTRATION

Facilities Management, Design and Construction

SECTION 000107 - PROFESSIONAL SEALS AND CERTIFICATIONS

PROJECT NUMBER: C2415-01 "BACKUP POWER EQUIPMENT REPLACEMENT – FULTON RECEPTION AND DIAGNOSTIC CENTER"

THE FOLLOWING DESIGN PROFESSIONALS HAVE SIGNED AND SEALED THE ORIGINAL PLANS AND SPECIFICATIONS FOR THIS PROJECT, WHICH ARE ON FILE WITH THE DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION:

STRUCTURAL

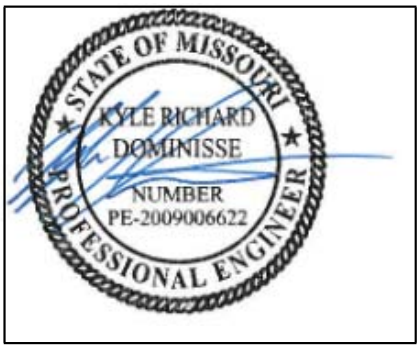
The documents intended to be authenticated by my seal are limited to:

Drawings Sheets: S000, S001, S002, S100

I hereby disclaim any responsibility for all other plans, specifications, estimates, reports or other documents or instruments relating to or intended to be used for any part of the project.

By:_____

Kyle Dominisse, P.E.



PLUMBING

The documents intended to be authenticated by my seal are limited to:

Drawings Sheets: P201.C

I hereby disclaim any responsibility for all other plans, specifications, estimates, reports or other documents or instruments relating to or intended to be used for any part of the project.

By: _____

Kelley P. Cramm, P.E. (Div. 22)

09/26/25

ELECTRICAL

The documents intended to be authenticated by my seal are limited to:

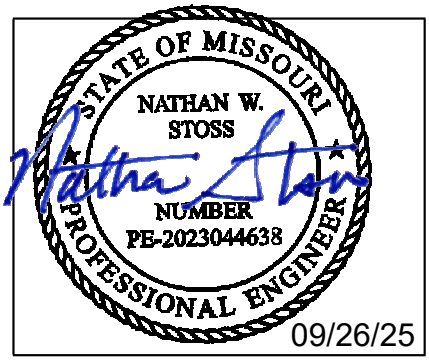
Specifications: Division 26 all Sections

Drawings Sheets: E000, E001, DE201.C, DE800, E100, E201.C, E600, E800, E801, E900

I hereby disclaim any responsibility for all other plans, specifications, estimates, reports or other documents or instruments relating to or intended to be used for any part of the project.

By: _____

Nathan W. Stoss, P.E. (Div. 26)



09/26/25

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NOTICE TO BIDDERS

The following procurement forms can be found on our website at:
https://oa.mo.gov/facilities/bid-opportunities/bid-listing-electronic-plans
and shall be submitted with your bid to FMDCBids@oa.mo.gov

SECTION 000115 – LIST OF DRAWINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section provides a comprehensive list of the drawings that comprise the Bid Documents for this project.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 LIST OF DRAWINGS

A. The following list of drawings is a part of the Bid Documents:

	TITLE	SHEET #	DATE	CAD #
1.	Cover Sheet	G000	9/26/25	G000
2.	General Notes	S000	9/26/25	S000
3.	General Notes	S001	9/26/25	S001
4.	General Notes	S002	9/26/25	S002
5.	Structural Plan – Building C	S100	9/26/25	S100
6.	Plumbing Plan - Building C	P201.C	9/26/25	P201.C
7.	Electrical Legend	E000	9/26/25	E000
8.	Electrical General Notes	E001	9/26/25	E001
9.	Power Demo Plan - Building C	DE201.C	9/26/25	DE201.C
10.	Electrical Demo OneLine	DE800	9/26/25	DE800
11.	Electrical Plan – Overall	E100	9/26/25	E100
12.	Power Plan – Building C	E201.C	9/26/25	E201.C
13.	Panelboard Schedules	E600	9/26/25	E600
14.	General Power OneLine	E800	9/26/25	E800
15.	Emergency Power OneLine	E801	9/26/25	E801
16.	Electrical Details	E900	9/26/25	E900

END OF SECTION 000115

SECTION 001116 - INVITATION FOR BID

1.0 OWNER:

A. The State of Missouri
Office of Administration,
Division of Facilities Management, Design and Construction
Jefferson City, Missouri

2.0 PROJECT TITLE AND NUMBER:

A. Backup Power Equipment Replacement
Fulton Reception and Diagnostic Center
Fulton, Missouri
Project No.: C2415-01

3.0 BIDS WILL BE RECEIVED:

A. Until: 1:30 PM, December 2, 2025

B. **Only electronic bids sent to FMDCBids@oa.mo.gov shall be accepted: (See Instructions to Bidders for further detail)**

4.0 DESCRIPTION:

A. Scope: The project includes the replacement of existing generator with new. Replacement of existing day tank with new. Replacement of existing backup power switchgear with new. Replacement of existing automatic transfer switch with new, and the installation of a new mobile generator connection tap box.

B. MBE/WBE/SDVE Goals: MBE 0%, WBE 0%, and SDVE 3%. **NOTE: Only MBE/WBE firms certified by the State of Missouri Office of Equal Opportunity as of the date of bid opening, or SDVE(s) meeting the requirements of Section 34.074, RSMo and 1 CSR 30-5.010, can be used to satisfy the MBE/WBE/SDVE participation goals for this project.**

5.0 PRE-BID MEETING:

A. Place/Time**:** 9:00 AM, November 18, 2025, at Fulton Reception and Diagnostic Center – Maintenance Building, 1393 State Route O, Fulton, MO.

B. Access to State of Missouri property requires presentation of a photo ID by all persons

6.0 HOW TO GET PLANS & SPECIFICATIONS:

A. View Only Electronic bid sets are available at no cost or paper bid sets for a deposit of $100.00 from American Document Solutions (ADS). MAKE CHECKS PAYABLE TO: American Document Solutions. Mail to: American Document Solutions, 1400 Forum Blvd., Suite 7A, Columbia, Missouri 65203. Phone 573-446-7768, Fax 573-355-5433, https://www.adsplanroom.net. NOTE: Prime contractors will be allowed a maximum of two bid sets at the deposit rate shown above. Other requesters will be allowed only one bid set at this rate. Additional bid sets or parts thereof may be obtained by any bidder at the cost of printing and shipping by request to American Document Solutions at the address shown above. Bidder must secure at least one bid set to become a planholder.

B. **Refunds: Return plans and specifications in unmarked condition within 15 working days of bid opening to American Document Solutions, 1400 Forum Blvd., Suite 7A, Columbia, Missouri 65203. Phone 573-446-7768, Fax 573-355-5433. Deposits for plans not returned within 15 working days shall be forfeited.**

C. Information for upcoming bids, including downloadable plans, specifications, Invitation for Bid, bid tabulation, award, addenda, and access to the ADS planholders list, is available on the Division of Facilities Management, Design and Construction's web site: https://oa.mo.gov/facilities/bid-opportunities/bid-listing-electronic-plans.

7.0 POINT OF CONTACT:

A. Designer: Henderson Engineers, Inc., Nick Gordon, (913) 742-5000, email: nick.gordon@hendersonengineers.com

B. Project Manager: Shannon Thompson, (573) 257-7137, email: shannon.thompson@oa.mo.gov

8.0 GENERAL INFORMATION:

A. The State reserves the right to reject any and all bids and to waive all informalities in bids. No bid may be withdrawn for a period of 20 working days subsequent to the specified bid opening time. The contractor shall pay not less than the prevailing hourly rate of wages for work of a similar character in the locality in which the work is performed, as determined by the Missouri Department of Labor and Industrial Relations and as set out in the detailed plans and specifications.

B. Bid results will be available at https://oa.mo.gov/facilities/bid-opportunities/bid-listing-electronic-plans after it is verified that at least one bid is awardable and affordable.

SECTION 002113 – INSTRUCTIONS TO BIDDERS

1.0 - SPECIAL NOTICE TO BIDDERS

A. If awarded a contract, the Bidder's employees, and the employees of all subcontractors, who perform the work on the project must adhere to requirements in Section 013513 – Site Security and Health Requirements as applicable per Agency.

B. The Bidder's prices shall include all city, state, and federal sales, excise, and similar taxes that may lawfully be assessed in connection with the performance of work, and the purchased of materials to be incorporated in the work. **THIS PROJECT IS NOT TAX EXEMPT.**

2.0 - BID DOCUMENTS

A. The number of sets obtainable by one (1) party may be limited in accordance with available supply.

B. For the convenience of contractors, subcontractors and suppliers, bidding documents are available on the Owner's website at https://oa.mo.gov/facilities/bid-opportunities/bid-listing-electronic-plans.

3.0 - BIDDERS' OBLIGATIONS

A. Bidders must carefully examine the entire site of the work and shall make all reasonable and necessary investigations to inform themselves thoroughly as to the facilities available as well as to all the difficulties involved in the completion of all work in accordance with the specifications and the plans. Bidders are required to examine all maps, plans and data mentioned in the specifications. No plea of ignorance concerning observable existing conditions or difficulties that may be encountered in the execution of the work under this contract will be accepted as an excuse for any failure or omission on the part of the successful Bidder (contractor) to fulfill every detail of the requirements of the contract, nor accepted as a basis for any claims for extra compensation or time extension.

B. Under no circumstances will Bidders give their plans and specifications to other Bidders. It is highly encouraged, but not required, that all Bidders be on the official planholders list to receive project updates including but not limited to any addenda that are issued during the bidding process.

4.0 - INTERPRETATIONS

A. No Bidder shall be entitled to rely on oral or written representations from any person as to the meaning of the plans and specifications or the acceptability of alternate products, materials, form or type of construction.

B. Bidders shall make all requests for interpretations in writing and submit all requests to the Project Designer and Project Manager identified in Section 007300 – Supplementary Conditions with all necessary supporting documentation no less than five (5) working days before opening of bids. Responses to requests for interpretation will be issued via a written addendum and will be sent as promptly as is practicable to all official planholders and posted on the Owner's website. All such addenda shall become part of the bid and contract documents.

C. Bidders shall make all requests for an "Acceptable Substitution" on the Section 006325 Substitution Request Form. The request shall be emailed to the Project Designer and Project Manager identified in Section 007300 – Supplementary Conditions no less than five (5) working days before opening of bids. Responses to requests for substitutions will be issued via a written addendum and will be sent as promptly as is practicable to all official planholders and posted on the Owner's website. All such addenda shall become part of the bid and contract documents.

D. An "Acceptable Substitution" requested after the award of bid will only be approved if proven to the satisfaction of the Owner and the Designer that the product is acceptable in design, strength, durability, usefulness, and convenience for the purpose intended. Approval of the substitution after award is at the sole discretion of the Owner and all requests of this nature must be submitted in accordance with Article 3.1 of the General Conditions.

5.0 - BIDS AND BIDDING PROCEDURE

A. Bidders shall submit all submission forms and accompanying documents listed in Section 004113 – Bid Form, Article 5.0, Attachments to Bid by the stated time on the bid documents or the bid will be rejected for being non-responsive.

B. Depending on the specific project requirements, **the following is a GENERIC list** of all possible bid forms that may be due with bid submittals. Bidders must verify each specific project's requirements in Section 004113 to ensure they have provided all the required documentation with their submission.

Bid Submittal – due before stated date and time of bid opening (see IFB):

004113	Bid Form (all pages are always required)
004322	Unit Prices Form
004336	Proposed Subcontractors Form
004337	MBE/WBE/SDVE Compliance Evaluation Form
004338	MBE/WBE/SDVE Eligibility Determination for Joint Ventures
004339	MBE/WBE/SDVE GFE Determination
004340	SDVE Business Form
004541	Affidavit of Work Authorization
004545	Anti-Discrimination Against Israel Act Certification form

C. The Bidder shall submit its bid on the forms provided by the Owner in the same file format (PDF) with each space fully and properly completed, typewritten or legibly printed, including all amounts required for alternate bids, unit prices, cost accounting data, etc. The Owner will reject bids that are not on the Owner's forms or that do not contain all requested information. All forms can be found on the Owner's website at https://oa.mo.gov/facilities/bid-opportunities/bid-listing-electronic-plans and shall be submitted with your bid to FMDCBids@oa.mo.gov.

D. All bids shall be submitted without additional terms and conditions, modifications, or reservations. The completed forms should not include interlineations, alterations, or erasures. Bids not in compliance with the requirements of this paragraph will be rejected as non-responsive.

E. All bids shall be accompanied by a bid bond executed by the bidder and a duly authorized surety company, certified check, cashier's check or bank draft made payable to the Division of Facilities Management, Design and Construction, State of Missouri, in the amount indicated in the bid documents in Section 004113. Failure of the Bidder to submit the duly authorized bid bond or the full amount required shall be sufficient cause to reject his bid. The Bidder agrees that the proceeds of the check, draft, or bond shall become the property of the State of Missouri, if for any reason the Bidder withdraws his bid after bid closing or if the Bidder, within ten (10) working days after notification of award, refuses or is unable to 1) execute the tendered contract, 2) provide an acceptable performance and payment bond, or 3) provide evidence of required insurance coverage.

F. The bid bond check or draft submitted by the successful Bidder will be returned after the receipt of an acceptable performance and payment bond and execution of the formal contract. Checks or drafts of all other Bidders will be returned within a reasonable time after it is determined that the bid represented by same will receive no further consideration by the State of Missouri.

6.0 - SIGNING OF BIDS

A. A bid should contain the full and correct legal name of the Bidder. If the Bidder is an entity registered with the Missouri Secretary of State, the Bidder's name on the bid form should appear as shown in the Secretary of State's records. If the Bidder is an entity organized in a state other than Missouri, the Bidder must provide a Certificate of Authority to do business in the State of Missouri.

B. If the successful Bidder is doing business in the State of Missouri under a fictitious name, the Bidder shall furnish to Owner, attached to the Bid Form, a properly certified copy of the certificate of Registration of Fictitious Name from the State of Missouri, and such certificate shall remain on file with the Owner.

C. A bid from an individual shall be signed as noted on the Bid Form.

D. A bid from a partnership or joint venture shall require only one signature of a partner, an officer of the joint venture authorized to bind the venture, or an attorney-in-fact. If the bid is signed by an officer of

a joint venture or an attorney-in-fact, a document evidencing the individual's authority to execute contracts should be included with the bid form.

E. A bid from a limited liability company (LLC) shall be signed by a manager or a managing member of the LLC.

F. A bid from a corporation shall have the correct corporate name thereon and the signature of an authorized officer of the corporation. Title of office held by the person signing for the corporation shall appear, along with typed name of said individual and the corporate license number shall be provided. In addition, for corporate proposals, the President or Vice-President listed per the current filing with the Missouri Secretary of State should sign as the Bidder. If the signatory is other than the corporate president or vice president, the bidder must provide satisfactory evidence that the signatory has the legal authority to bind the corporation.

7.0 - RECEIVING BID SUBMITTALS

A. It is the Bidder's sole responsibility to ensure receipt of the bid submittals by Owner on or before the date and time specified in the Invitation for Bid or as modified via written addenda. Bids received after the date and time specified will not be considered by the Owner.

B. All bids shall be received via email at FMDCBids@oa.mo.gov and bids received by the Owner through any other means, including hard copies, will not be considered, and will be discarded by the Owner unopened.

8.0 - MODIFICATION AND WITHDRAWAL OF BIDS

A. Bidder may withdraw a bid at any time prior to the scheduled closing time for receipt of bids, but no bidder may withdraw his bid for a period of twenty (20) working days after the scheduled closing time for receipt of bids.

B. Bidder may modify a bid until the scheduled closing time by sending a revised bid to FMDCBids@oa.mo.gov with a note in the subject line and body of the email that it is a revised bid. All revised bids must be submitted to FMDCBids@oa.mo.gov, revised bids sent any other way will not be considered.

9.0 - AWARD OF CONTRACT

A. The Owner reserves the right to reject any and/or all bids and further to waive all informalities in bidding when deemed in the best interest of the State of Missouri.

B. The Owner reserves the right to let other contracts in connection with the work including, but not limited to, contracts for the furnishing and installation of furniture, equipment, machinery, appliances and other apparatuses.

C. The Owner will award a contract to the lowest, responsive, and responsible Bidder in accordance with Section 8.250, RSMo. No contract will be awarded to any Bidder who has had a contract with the Owner terminated within the preceding twelve months for material breach of contract or who has been suspended or debarred by the Owner.

D. Award of alternates, if any, will be made in numerical order unless all bids received are such that the order of acceptance of alternates does not affect the determination of the lowest, responsive, responsible bidder.

E. No award shall be considered binding upon the Owner until the written contract has been properly executed and the following documentation has been provided: 1) performance and payment bond consistent with Article 6.1 of the General Conditions; 2) proof of the required insurance coverage; 3) an executed Section 004541 - Affidavit of Work Authorization form; and 4) documentation evidence enrollment and participation in a federal work authorization program.

F. Failure to execute and return the contract and associated documents within the prescribed period shall be treated, at the option of the Owner, as a breach of Bidder's obligation and the Owner shall be under no further obligation to Bidder.

G. Transient employers subject to Sections 285.230 and 285.234, RSMo, (out-of-state employers who temporarily transact any business in the State of Missouri) may be required to file a bond with the

Missouri Department of Revenue. No contract will be awarded by the Owner unless the successful Bidder certifies that he has complied with all applicable provisions of Section 285.230-234.

H. Sections 285.525 and 285.530, RSMo, require business entities to enroll and participate in a federal work authorization program in order to be eligible to receive award of any state contract in excess of $5,000. Bidders should submit with their bid an Affidavit of Work Authorization (Section 004541) along with appropriate documentation evidencing such enrollment and participation. Bidders must also submit an E-Verify Memorandum before the Owner may award a contract to the Bidder. Information regarding a E-Verify is located at https://www.e-verify.gov/employers/enrolling-in-e-verify. The contractor shall be responsible for ensuring that all subcontractors and suppliers associated with this contract enroll in E-Verify.

I. The successful Bidder must be registered in MissouriBUYS powered by MOVERS at https://missouribuys.mo.gov/supplier-registration# as an approved vendor prior to being issued a contract.

10.0 - CONTRACT SECURITY

A. The successful Bidder shall furnish a performance/payment bond as set forth in General Conditions Article 6.1 prior to the State executing the contract and issuing a notice to proceed.

11.0 - LIST OF SUBCONTRACTORS

A. If required by "Section 004113 – Bid Form," each Bidder must submit as part of their bid a list of subcontractors to be used in performing the work (Section 004336). The list must specify the name of the single designated subcontractor, manufacturer, or suppliers for each category of work listed in "Section 004336 - Proposed Subcontractors Form." If work within a category will be performed by more than one subcontractor, the bidder must provide the name of each subcontractor and specify the exact portion of the work to be done by each. If the Bidder intends to perform any of the designated subcontract work with the use of his own employees, the Bidder shall make that fact clear, by listing his own firm for the subject category. **If any category of work is left vacant or if more than one subcontractor is listed for any category without designating the portion of work to be performed by each, the bid shall be rejected.**

12.0 - WORKING DAYS

A. Contract duration time is stated in working days and will use the following definition in determining the actual calendar date for contract completion:

1. Working days are defined as all calendar days except Saturdays, Sundays and the following State of Missouri observed holidays: New Year's Day, Martin Luther King, Jr. Day, Lincoln Day, Washington's Birthday, Truman Day, Memorial Day, Juneteenth, Independence Day, Labor Day, Columbus Day, Veterans Day, Thanksgiving Day and Christmas Day.

13.0 - AMERICAN AND MISSOURI - MADE PRODUCTS AND FIRMS

A. By signing the bid form and submitting a bid on this project, the Bidder certifies that it will use American and Missouri products as set forth in Article 1.7 of the General Conditions. Bidders are advised to review those requirements carefully prior to bidding.

B. A preference shall be given to Missouri firms, corporations or individuals, or firms, corporations or individuals that maintain Missouri offices or places of business, when the quality of performance promised is equal or better and the price quoted is the same or less.

C. Pursuant to Section 34.076, RSMo, a contractor or Bidder domiciled outside the boundaries of the State of Missouri shall be required, in order to be successful, to submit a bid the same percent less than the lowest bid submitted by a responsible contractor or Bidder domiciled in Missouri as would be required for such a Missouri domiciled contractor or Bidder to succeed over the bidding contractor or Bidder domiciled outside Missouri on a like contract or bid being let in the Bidder's domiciliary state and, further, the contractor or Bidder domiciled outside the boundaries of Missouri shall be required to submit an audited financial statement as would be required of a Missouri domiciled contractor or Bidder on a like contract or bid being let in the domiciliary state of that contractor or Bidder.

14.0 – ANTI-DISCRIMINATION AGAINST ISRAEL ACT CERTIFICATION:

A. If the Bidder meets the section 34.600, RSMo., definition of a "company" and the Bidder has ten or more employees, the Bidder must certify in writing that the Bidder is not currently engaged in a boycott of goods or services from the State of Israel and shall not engage in a boycott of goods or services from the State of Israel, if awarded a contract, for the duration of the contract. The Bidder is required to complete and submit the applicable portion of Section 004545 - Anti-Discrimination Against Israel Act Certification with its Bid Form. The applicable portion of the exhibit must be submitted prior to execution of a contract by the Owner and issuance of Notice to Proceed.

15.0 - MBE/WBE/SDVE INSTRUCTIONS

A. Definitions:

1. **"MBE"** means a Minority Business Enterprise.

2. **"MINORITY"** has the same meaning as set forth in 1 C.S.R. 10-17.010.

3. **"MINORITY BUSINESS ENTERPRISE"** has the same meaning as set forth in section 37.020, RSMo.

4. **"WBE"** means a Women's Business Enterprise.

5. **"WOMEN'S BUSINESS ENTERPRISE"** has the same meaning as set forth in section 37.020, RSMo.

6. **"SDVE"** means a Service-Disabled Veterans Enterprise.

7. **"SERVICE-DISABLED VETERAN"** has the same meaning as set forth in section 34.074, RSMo.

8. **"SERVICE-DISABLED VETERAN ENTERPRISE"** has the same meaning as "Service-Disabled Veteran Business" set forth in section 34.074, RSMo.

B. MBE/WBE/SDVE General Requirements:

1. For all bids greater than $100,000, the Bidder shall obtain MBE, WBE and SDVE participation in an amount equal to or greater than the percentage goals set forth in the Invitation for Bid and the Bid Form, unless the Bidder is granted a Good Faith Effort waiver by the Director of the Division, as set forth below. If the Bidder does not meet the MBE, WBE and SDVE goals, or make a good faith effort to do so, the Bidder shall be nonresponsive, and its bid shall be rejected.

2. The Bidder should submit with its bid all the information requested in the MBE/WBE/SDVE Compliance Evaluation Form for every MBE, WBE, or SDVE subcontractor or material supplier the Bidder intends to use for the contract work. The Bidder is required to submit all MBE/WBE/SDVE documentation before the stated time and date set forth in the Invitation for Bid. If the Bidder fails to provide such information by the specified date and time, the Owner shall reject the bid.

3. The Director reserves the right to request additional information from a Bidder to clarify the Bidder's proposed MBE, WBE, and/or SDVE participation. The Bidder shall submit the clarifying information requested by the Owner within two (2) working days of receiving the request for clarification.

4. Pursuant to section 34.074, RSMo, a Prime Bidder that qualifies as an SDVE shall receive a three-percentage point bonus preference in the contract award evaluation process. The bonus preference will be calculated and applied by reducing the bid amount of the eligible SDVE by three percent of the apparent low responsive Bidder's bid. Based on this calculation, if the eligible SDVE's evaluation is less than the apparent low responsive Bidder's bid, the eligible SDVE's bid will become the apparent low responsive bid. This reduction is for evaluation purposes only and will have no impact on the actual amount(s) of the bid or the amount(s) of any contract awarded. In order to be eligible for the SDVE preference, the Bidder must complete and submit with its bid the Missouri Service-Disabled Veteran Business Form, and any information required by the form.

C. Computation of MBE/WBE/SDVE Goal Participation:

1. A Bidder who is a MBE, WBE, or SDVE may count 100% of the contract towards the MBE, WBE or SDVE goal, less any amounts awarded to another MBE, WBE or SDVE. (NOTE: a MBE firm that bids as general contractor must obtain WBE and SDVE participation; a WBE firm that bids as

a general contractor must obtain MBE and SDVE participation; and a SDVE firm that bids as general contractor must obtain MBE and WBE participation.) For the remaining contract amount to be counted towards the MBE, WBE or SDVE goal, the Bidder must complete the MBE/WBE/SDVE Compliance Evaluation Form (Section 004337) identifying itself as an MBE, WBE or SDVE.

2. The total dollar value of the work granted to a certified MBE, WBE or SDVE by the Bidder shall be counted towards the applicable goal.

3. Expenditures for materials and supplies obtained from a certified MBE, WBE, or SDVE supplier or manufacturer may be counted towards the MBE, WBE and SDVE goals, if the MBE, WBE, or SDVE assumes the actual and contractual responsibility for the provision of the materials and supplies.

4. The total dollar value of the work granted to a second or subsequent tier subcontractor or a supplier may be counted towards a Bidder's MBE, WBE and SDVE goals, if the MBE, WBE, or SDVE properly assumes the actual and contractual responsibility for the work.

5. The total dollar value of work granted to a certified joint venture equal to the percentage of the ownership and control of the MBE, WBE, or SDVE partner in the joint venture may be counted towards the MBE/WBE/SDVE goals.

6. Only expenditures to a MBE, WBE, or SDVE that performs a commercially useful function in the work may be counted towards the MBE, WBE and SDVE goals. A MBE, WBE, or SDVE performs a commercially useful function when it is responsible for executing a distinct element of the work and carrying out its responsibilities by performing, managing and supervising the work or providing supplies or manufactured materials.

D. Certification of MBE/WBE/SDVE Subcontractors:

1. In order to be counted towards the goals, an MBE or WBE must be certified by the State of Missouri Office of Equal Opportunity and an SDVE must be certified by the State of Missouri, Office of Equal Opportunity or by the Federal U.S. Small Business Administration directory.

2. The Bidder may determine the certification status of a proposed MBE or WBE subcontractor or supplier by referring to the Office of Equal Opportunity (OEO)'s online MBE/WBE directory https://apps1.mo.gov/MWBCertifiedFirms/. The Bidder may determine the eligibility of a SDVE subcontractor or supplier by referring to the Office of Equal Opportunity online SDVE directory at https://oeo.mo.gov/sdve-certification-program/ or the Federal U.S. Small Business Administration directory https://veterans.certify.sba.gov/#search.

3. Additional information, clarifications, or other information regarding the MBE/WBE/SDVE listings in the directories may be obtained by contacting the Contract Specialist of record as shown in the Supplementary Conditions (Section 007300).

E. Waiver of MBE/WBE/SDVE Participation:

1. If a Bidder has made a good faith effort to secure the required MBE, WBE and/or SDVE participation and has failed, the Bidder shall submit with its bid the information requested in MBE/WBE/SDVE Good Faith Effort (GFE) Determination form. The Director will determine if the Bidder made a good faith effort to meet the applicable goals. If the Director determines that the Bidder did not make a good faith effort, the bid shall be rejected as being nonresponsive to the bid requirements. Bidders who demonstrate that they have made a good faith effort to include MBE, WBE, and/or SDVE participation will be granted a waiver and will be considered to be responsive to the applicable participation goals, regardless of the percent of actual participation obtained, if the bid is otherwise acceptable.

2. In determining whether a Bidder has made a good faith effort to obtain MBE, WBE and/or SDVE participation, the Director may evaluate the factors set forth in 1 CSR 30-5.010(6)(C) and the following:

   a. The amount of actual participation obtained;

b. How and when the Bidder contacted potential MBE, WBE, and SDVE subcontractors and suppliers;

c. The documentation provided by the Bidder to support its contacts, including whether the Bidder provided the names, addresses, phone numbers, and dates of contact for MBE/WBE/SDVE firms contacted for specific categories of work;

d. If project information, including plans and specifications, were provided to MBE/WBE/SDVE subcontractors;

e. Whether the Bidder made any attempts to follow-up with MBE, WBE or SDVE firms prior to bid;

f. Amount of bids received from any of the subcontractors and/or suppliers that the Bidder contacted;

g. The Bidder's stated reasons for rejecting any bids;

F. Contractor MBE/WBE/SDVE Obligations

1. If awarded a contract, the Bidder will be contractually required to subcontract with or obtain materials from the MBE, WBE, and SDVE firms listed in its bid, in amounts equal to or greater than the dollar amount in the bid, unless the amount is modified in writing by the Owner.

2. If the Contractor fails to meet or maintain the participation requirements contained in the Contractor's bid, the Contractor must satisfactorily explain to the Director why it cannot comply with the requirement and why failing meeting the requirement was beyond the Contractor's control. If the Director finds the Contractor's explanation unsatisfactory, the Director may take any appropriate action including, but not limited to:

   a. Declaring the Contractor ineligible to participate in any contracts with the Division for up to twelve (12) months (suspension); and/or

   b. Declaring the Contractor be nonresponsive to the Invitation for Bid, or in breach of contract and rejecting the bid or terminating the contract.

3. If the Contractor replaces an MBE, WBE, or SDVE during the course of the contract, the Contractor shall replace it with another MBE, WBE, or SDVE or make a good faith effort to do so. All MBE, WBE and SDVE substitutions must be approved by the Director in writing.

4. The Contractor shall provide the Owner with regular reports on its progress in meeting its MBE/WBE/SDVE obligations. At a minimum, the Contractor shall report the dollar-value of work completed by each MBE, WBE, or SDVE during the preceding month and the cumulative total of work completed by each MBE, WBE or SDVE to date with each monthly application for payment. The Contractor shall also make a final report, which shall include the total dollar-value of work completed by each MBE, WBE, and SDVE during the entire contract.

State of Missouri
Construction Contract

THIS AGREEMENT is made (DATE) by and between:

Contractor Name and Address

hereinafter called the "Contractor," and the **State of Missouri**, hereinafter called the **"Owner"**, represented by the Office of Administration, Division of Facilities Management, Design and Construction.

WITNESSETH, that the Contractor and the Owner, for the consideration stated herein agree as follows:

ARTICLE 1. STATEMENT OF WORK

The Contractor shall furnish all labor and materials and perform all work required for furnishing and installing all labor, materials, equipment and transportation and everything necessarily inferred from the general nature and tendency of the plans and specifications for the proper execution of the work for:

Project Name: **Backup Power Equipment Replacement**
Fulton Reception and Diagnostic Center
Fulton, Missouri

Project Number: **C2415-01**

in strict accordance with the Contract Documents as enumerated in Article 7, all of which are made a part hereof.

ARTICLE 2. TIME OF COMPLETION

The contract performance time is **200 working days** from the transmittal date of this agreement. The contract completion date is **MONTH, DAY, YEAR**. This time includes ten (10) working days for the Contractor to receive, sign and return the contract form along with required bonding and insurance certificates. Failure of the Contractor to provide correct bonding and insurance within the ten (10) working days shall not be grounds for a time extension. Receipt of proper bonding and insurance is a condition precedent to the formation of the contract and if not timely received, may result in forfeiture of the Contractor's bid security. Work may not commence until the Owner issues a written Notice to Proceed and must commence within seven (7) working days thereafter.

ARTICLE 3. LIQUIDATED DAMAGES

Whenever time is mentioned in this contract, time shall be and is of the essence of this contract. The Owner would suffer a loss should the Contractor fail to have the work embraced in this contract fully completed on or before the time above specified. THEREFORE, the parties hereto realize in order to adjust satisfactorily the damages on account of such failure that it might be impossible to compute accurately or estimate the amount of such loss or damages which the Owner would sustain by reason of failure to complete fully said work within the time required by this contract. The Contractor hereby covenants and agrees to pay the Owner, as and for **liquidated damages, the sum of $1,000** per day for each and every day, Sunday and legal holidays excepted, during which the work remains incomplete and unfinished. Any sum which may be due the Owner for such damages shall be deducted and retained by the Owner from any balance which may be due the Contractor when said work shall have been finished and accepted. But such provisions shall not release the Bond of the Contractor from liability according to its terms. In case of failure to complete, the Owner will be under no obligation to show or prove any actual or specific loss or damage.

ARTICLE 4. CONTRACT SUM

The Owner shall pay the Contractor for the prompt, faithful and efficient performance of the conditions and undertakings of this contract, subject to additions, and deductions as provided herein, in current funds the sum of:

Base Bid: $

Accepted Alternates, if applicable to the Project and accepted by the Owner.

TOTAL CONTRACT AMOUNT: ($CONTRACT AMOUNT)

UNIT PRICES: The Owner accepts the following Unit Prices:

For changing specified quantities of work from those indicated by the contract drawings and specifications, upon written instructions of Owner, the following unit prices shall prevail. The unit prices include all labor, overhead and profit, materials, equipment, appliances, bailing, shoring, shoring removal, etc., to cover the finished work of the several kinds of work called for. Only a single unit price shall be given and it shall apply for either MORE or LESS work than that shown on the drawings and called for in the specifications or included in the Base Bid. In the event of more or less units than so indicated or included, change orders may be issued for the increased or decreased amount.

ARTICLE 5. PREVAILING WAGE RATE

MISSOURI PREVAILING WAGE LAW (Sections 290.210 to 290.340, RSMo): The Contractor shall pay not less than the specified hourly rate of wages, as set out in the wage order attached to and made part of the specifications for work under this contract, to all workers performing work under the contract, in accordance with sections 290.210 to 290.340, RSMo. The Contractor shall forfeit a penalty to the Owner of one hundred dollars per day (or portion of a day) for each worker that is paid less than the specified rates for any work done under the contract by the Contractor or by any subcontractor, in accordance with section 290.250, RSMo.

DAVIS-BACON ACT: If this Project is financed in whole or in part from Federal funds (as indicated in the Instructions to Bidders or other bid or contract documents for this Project), then this contract shall be subject to all applicable federal labor statutes, rules and regulations, including provisions of the Davis-Bacon Act, 40 U.S.C. §3141 et seq., and the "Federal Labor Standards Provisions," as further set forth in Section 007333 – Supplementary General Conditions for Federally Funded/Assisted Construction Projects, which is incorporated into the contract by reference. Where the Missouri Prevailing Wage Law and the Davis-Bacon Act require payment of different wages for work performed under this contract, the Contractor and all Subcontractors shall pay the greater of the wages required under either law, on a classification-by-classification basis.

ARTICLE 6. MINORITY/WOMEN/SERVICE DISABLED VETERAN BUSINESS ENTERPRISE PARTICIPATION

The Contractor has been granted a waiver of the 10% MBE and 10% WBE and 3% SDVE participation goals. The Contractor agrees to secure the MBE/WBE/SDVE participation amounts for this project as follows: (OR)

The Contractor has met the MBE/WBE/SDVE participation goals and agrees to secure the MBE/WBE/SDVE participation amounts for this project as follows:

MBE/WBE/SDVE Firm: Subcontract Amt:$
MBE/WBE/SDVE Firm: Subcontract Amt:$
MBE/WBE/SDVE Firm: Subcontract Amt:$

Total $

MBE/WBE/SDVE assignments identified above shall not be changed without a contract change signed by the Owner.

The Director of the Division of Facilities Management, Design and Construction or his Designee shall be the final authority to resolve disputes and disagreements between the Contractor and the MBE/WBE/SDVE firms listed above when such disputes impact the subcontract amounts shown above.

ARTICLE 7. CONTRACT DOCUMENTS

The following documents are hereby incorporated into this contract by reference (all division/section numbers and titles are as utilized in the Project Manual published by the Owner for this Project):

1. Division 0 – Procurement and Contracting Information, including, but not limited to:
    a. Invitation for Bid (Section 001116)
    b. Instructions to Bidders (Section 002113)
    c. Supplementary Instructions to Bidders (if applicable) (Section 002213)
    d. The following documents as completed and executed by the Contractor and accepted by the Owner, if applicable:
        i. Bid Form (Section 004113)
        ii. Unit Prices (Section 004322)
        iii. Proposed Contractors Form (Section 004336)
        iv. MBE, WBE, SDVE Compliance Evaluation Form(s) (Section 004337)
        v. MBE, WBE, SDVE Eligibility Determination Form for Joint Ventures (Section 004338)
        vi. MBE, WBE, SDVE Good Faith Effort (GFE) Determination Form (Section 004339)
        vii. Missouri Service Disabled Veteran Business Form (Section 004340)
        viii. Affidavit of Work Authorization (Section 004541)
    e. Performance and Payment Bond, completed and executed by the Contractor and surety (Section 006113)
    f. General Conditions (Section 007213)
    g. Supplementary Conditions (Section 007300)
    h. Supplementary General Conditions for Federally Funded/Assisted Construction Projects (Section 007333), if applicable
    i. Wage Rate(s) (Section 007346)
2. Division 1 – General Requirements
3. All Drawings identified in the Project Manual
4. All Technical Specifications included in the Project Manual
5. Addenda, if applicable

ARTICLE 8 – CERTIFICATION

By signing this contract, the Contractor hereby re-certifies compliance with all legal requirements set forth in Section 6.0, Bidder's Certifications of the Bid Form.

By signature below, the parties hereby execute this contract document.

APPROVED:

_____
Brian Yansen, Director
Division of Facilities Management,
Design and Construction

_____
Contractor's Authorized Signature

I, Corporate Secretary, certify that I am Secretary of the corporation named above and that (CONTRACTOR NAME), who signed said contract on behalf of the corporation, was then (TITLE) of said corporation and that said contract was duly signed for and in behalf of the corporation by authority of its governing body, and is within the scope of its corporate powers.

_____
Corporate Secretary

Bond No._____

SECTION 006113 - PERFORMANCE AND PAYMENT BOND FORM

KNOW ALL MEN BY THESE PRESENTS, THAT we _____

as principal, and _____

_____as Surety, are held and firmly bound unto the

STATE OF MISSOURI. in the sum of _____ Dollars ($)

for payment whereof the Principal and Surety bind themselves, their heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

WHEREAS, the Principal has, by means of a written agreement dated the _____

day of_____, 20_____, enter into a contract with the State of Missouri for

_____

_____

_____

(Insert Project Title and Number)

NOW, THEREFORE, if the Principal shall faithfully perform and fulfill all the undertakings, covenants, terms, conditions and agreements of said contract during the original term of said contract and any extensions thereof that may be granted by the State of Missouri, with or without notice to the Surety and during the life of any guaranty required under the contract; and shall also faithfully perform and fulfill all undertakings, covenants, terms, conditions and agreements of any and all duly authorized modifications of said contract that may hereafter be made with or without notice to the Surety; and shall also promptly make payment for materials incorporated, consumed or used in connection with the work set forth in the contract referred to above, and all insurance premiums, both compensation and all other kinds of insurance, on said work, and for all labor performed on such work, whether by subcontractor or otherwise, at not less than the prevailing hourly rate of wages for work of a similar character (exclusive of maintenance work) in the locality in which the work is performed and not less than the prevailing hourly rate of wages for legal holiday and overtime work (exclusive of maintenance work) in the locality in which the work is performed both as determined by the Department of Labor and Industrial Relations or determined by the Court of Appeal, as provided for in said contract and in any and all duly authorized modifications of said contract that may be hereafter made, with or without notice to the Surety, then, this obligation shall be void and of no effect, but it is expressly understood that if the Principal should make default in or should fail to strictly, faithfully and efficiently do, perform and comply with any or more of the covenants, agreements, stipulations, conditions, requirements or undertakings, as specified in or by the terms of said contract, and with the time therein named, then this obligation shall be valid and binding upon each of the parties hereto and this bond shall remain in full force and effect; and the same may be sued on at the instance of any material man, laborer, mechanic, subcontractor, individual, or otherwise to whom such payment is due, in the name of the State of Missouri, to the use of any such person.

AND, IT IS FURTHER specifically provided that any modifications which may hereinafter be made in the terms of the contract or in the work to be done under it or the giving by the Owner of any extension of the time for the performance of the contract or any other forbearance on the part of either the Owner or the Principal to the other, shall not in any way release the Principal and the Surety, or either or any of them, their heirs, executors, administrators and successors, from their liability hereunder, notice to the Surety of any such extension, modifications or forbearance being hereby waived.

IN WITNESS WHEREOF, the above bounden parties have executed the within instrument this _____ day of _____, 20 ____.

AS APPLICABLE:

AN INDIVIDUAL

Name: _____

Signature: _____

A PARTNERSHIP

Name of Partner: _____

Signature of Partner: _____

Name of Partner: _____

Signature of Partner: _____

CORPORATION

Firm Name: _____

Signature of President: _____

SURETY

Surety Name: _____

Attorney-in-Fact: _____

Address of Attorney-in-Fact: _____

_____

Telephone Number of Attorney-in-Fact: _____

Signature Attorney-in-Fact: _____

NOTE: Surety shall attach Power of Attorney

STATE OF MISSOURI
OFFICE OF ADMINISTRATION
DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION

PRODUCT SUBSTITUTION REQUEST

PROJECT NUMBER

PROJECT TITLE AND LOCATION

CHECK APPROPRIATE BOX

☐ SUBSTITUTION PRIOR TO BID OPENING
(Minimum of (5) working days prior to receipt of Bids as per Article 4 – Instructions to Bidders)

☐ SUBSTITUTION FOLLOWING AWARD
(Maximum of (20) working days from Notice to Proceed as per Article 3 – General Conditions)

FROM: BIDDER/CONTRACTOR (PRINT COMPANY NAME)

TO: ARCHITECT/ENGINEER (PRINT COMPANY NAME)

Bidder/Contractor hereby requests acceptance of the following product or systems as a substitution in accordance with provisions of Division One of the Bidding Documents:

SPECIFIED PRODUCT OR SYSTEM

SPECIFICATION SECTION NO.

SUPPORTING DATA

☐ Product data for proposed substitution is attached (include description of product, standards, performance, and test data)

☐ Sample ☐ Sample will be sent, if requested

QUALITY COMPARISON

	SPECIFIED PRODUCT	SUBSTITUTION REQUEST
NAME, BRAND		
CATALOG NO.		
MANUFACTURER		
VENDOR		

PREVIOUS INSTALLATIONS

PROJECT	ARCHITECT/ENGINEER
LOCATION	DATE INSTALLED

SIGNIFICANT VARIATIONS FROM SPECIFIED PRODUCT

REASON FOR SUBSTITUTION

DOES PROPOSED SUBSTITUTION AFFECT OTHER PARTS OF WORK?

☐ YES ☐ NO

IF YES, EXPLAIN

SUBSTITUTION REQUIRES DIMENSIONAL REVISION OR REDESIGN OF STRUCTURE OR A/E WORK

☐ YES ☐ NO

BIDDER'S/CONTRACTOR'S STATEMENT OF CONFORMANCE OF PROPOSED SUBSTITUTION TO CONTRACT REQUIREMENT:

We have investigated the proposed substitution. We believe that it is equal or superior in all respects to specified product, except as stated above; that it will provide the same Warranty as specified product; that we have included complete implications of the substitution; that we will pay redesign and other costs caused by the substitution which subsequently become apparent; and that we will pay costs to modify other parts of the Work as may be needed, to make all parts of the Work complete and functioning as a result of the substitution.

BIDDER/CONTRACTOR	DATE

REVIEW AND ACTION

☐ Resubmit Substitution Request with the following additional information:

☐ Substitution is accepted.

☐ Substitution is accepted with the following comments:

☐ Substitution is not accepted.

ARCHITECT/ENGINEER	DATE

STATE OF MISSOURI
OFFICE OF ADMINISTRATION
DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION

FINAL RECEIPT OF PAYMENT AND RELEASE

PROJECT NUMBER

KNOW ALL MEN BY THESE PRESENT THAT: hereinafter called "Subcontractor" who heretofore entered into an agreement with hereinafter called "Contractor", for the performance of work and/or furnishing of material for the construction of the project entitled

(PROJECT TITLE, PROJECT LOCATION, AND PROJECT NUMBER)

at

(ADDRESS OF PROJECT)

for the State of Missouri (Owner) which said subcontract is by this reference incorporated herein, in consideration of such final payment by Contractor.

DOES HEREBY:

1. ACKNOWLEDGE that they have been **PAID IN FULL** all sums due for work and materials contracted or done by their Subcontractors, Material Vendors, Equipment and Fixture Suppliers, Agents and Employees, or otherwise in the performance of the Work called for by the aforesaid Contract and all modifications or extras or additions thereto, for the construction of said project or otherwise.
2. RELEASE and fully, finally, and forever discharge the Owner from any and all suits, actions, claims, and demands for payment for work performed or materials supplied by Subcontractor in accordance with the requirements of the above referenced Contract.
1. REPRESENT that all of their Employees, Subcontractors, Material Vendors, Equipment and Fixture Suppliers, and everyone else has been **paid in full** all sums due them, or any of them, in connection with performance of said Work, or anything done or omitted by them, or any of them in connection with the construction of said improvements, or otherwise.

DATED this day of , 20 .

NAME OF SUBCONTRACTOR

BY (TYPED OR PRINTED NAME)

SIGNATURE

TITLE

ORIGINAL: FILE/Closeout Documents

STATE OF MISSOURI
OFFICE OF ADMINISTRATION
DIVISION OF FACILITIES MANAGEMENT,
DESIGN AND CONSTRUCTION

PAY APP NO.	PROJECT NUMBER
CHECK IF FINAL ☐**FINAL**	DATE

MBE/WBE/SDVE PROGRESS REPORT

Remit with **ALL** Progress and Final Payments

(Please check appropriate box) ☐CONSULTANT ☐CONSTRUCTION

PROJECT TITLE	
PROJECT LOCATION	
FIRM	
ORIGINAL CONTRACT SUM (Same as Line Item 1. on Form A of Application for Payment) **$**	TOTAL CONTRACT SUM TO DATE (Same as Line Item 3. on Form A of Application for Payment) **$**

THE TOTAL MBE/WBE/SDVE PARTICIPATION DOLLAR AMOUNT OF THIS PROJECT AS INDICATED IN THE ORIGINAL CONTRACT: **$**

SELECT MBE, WBE, SDVE	ORIGINAL CONTRACT PARTICIPATION AMOUNT	PARTICIPATION AMOUNT PAID-TO-DATE (includes approved contract changes)	CONSULTANT/SUBCONSULTANT OR CONTRACTOR/SUBCONTRACTOR/SUPPLIER COMPANY NAME
☐ MBE ☐ WBE ☐ SDVE	$	$	
☐ MBE ☐ WBE ☐ SDVE	$	$	
☐ MBE ☐ WBE ☐ SDVE	$	$	
☐ MBE ☐ WBE ☐ SDVE	$	$	
☐ MBE ☐ WBE ☐ SDVE	$	$	
☐ MBE ☐ WBE ☐ SDVE	$	$	

Revised 06/2023

INSTRUCTIONS FOR MBE/WBE/SDVE PROGRESS REPORT

CONTRACTOR OR CONSULTANT TO FILL OUT AND REMIT WITH EACH PAY APPLICATION:

The MBE/WBE/SDVE Progress Report for the project is issued with the contract comprising values reported in the consultant's Proposal or on the successful contractor's Section 004337 Compliance Evaluation Forms.

At Initial Pay Application fill in the following:

1. Pay App No. Start with 1.
2. Fill in the Project Number and Date.
3. Enter Project Title, Project Location, and Firm.
4. Fill in the "Original Contract Sum" and "Total Contract Sum To Date" (Reference applicable Line Items on Form A of Application for Payment).
5. Indicate the Total Participation Dollar Amount from the Original Contract.
6. Select MBE, WBE, or SDVE for each Consultant/Subconsultant or Contractor/Subcontractor/Supplier.
7. Enter the "Total Amount of Subcontract", "$ Amount (Paid-To-Date)", and Company Name.

For all subsequent Pay Applications fill in the following:

1. Pay App No.
2. If Final Pay App, check box.
3. Fill in the Project Number and Date.
4. Enter Project Title, Project Location, and Firm
5. At each Pay App fill in the "Original Contract Sum" and "Total Contract Sum To Date" (reference applicable Line Items on Form A of Application for Payment).
6. Indicate the Total Participation Dollar Amount from the Original Contract.
7. Select MBE, WBE, or SDVE for each Consultant/Subconsultant or Contractor/Subcontractor/Supplier
8. Enter the "Total Amount of Subcontract", "$ Amount (Paid-To-Date)", and Company Name.

STATE OF MISSOURI
OFFICE OF ADMINISTRATION
DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION
AFFIDAVIT – COMPLIANCE WITH PREVAILING WAGE LAW

PROJECT NUMBER

Before me, the undersigned Notary Public, in and for the County of _____

State of _____ personally came and appeared _____
(NAME)

_____ of the _____
(POSITION) (NAME OF THE COMPANY)

(a corporation) (a partnership) (a proprietorship) and after being duly sworn did depose and say that all provisions and requirements set out in Chapter 290, Sections 290.210 through and including 290.340, Missouri Revised Statutes, pertaining to the payment of wages to workmen employed on public works project have been fully satisfied and there has been no exception to the full and completed compliance with said provisions and requirements and with Wage Determination No: _____ issued by the Department of Labor and Industrial Relations, State of Missouri on the _____ day of _____ 20 __ in carrying out the contract and working in connection with _____
(NAME OF PROJECT)

Located at _____ in _____ County
(NAME OF THE INSTITUTION)

Missouri, and completed on the _____ day of _____ 20 __

SIGNATURE

NOTARY INFORMATION

NOTARY PUBLIC EMBOSSER OR BLACK INK RUBBER STAMP SEAL	STATE		COUNTY (OR CITY OF ST. LOUIS)
	SUBSCRIBED AND SWORN BEFORE ME, THIS DAY OF YEAR		**USE RUBBER STAMP IN CLEAR AREA BELOW**
	NOTARY PUBLIC SIGNATURE	MY COMMISSION EXPIRES	
	NOTARY PUBLIC NAME (TYPED OR PRINTED)		

FILE: Closeout Documents

GENERAL CONDITIONS

INDEX

A. These General Conditions apply to each section of these specifications. The Contractor is subject to the provisions contained herein.

B. The General Conditions are intended to define the relationship of the Owner, the Designer and the Contractor thereby establishing certain rules and provisions governing the operation and performance of the work so that the work may be performed in a safe, orderly, expeditious and workmanlike manner.

ARTICLE 1 – GENERAL PROVISIONS

ARTICLE 1.1 - DEFINITIONS

As used in these contract documents, the following terms shall have the meanings and refer to the parties designated in these definitions.

1. **"COMMISSIONER":** The Commissioner of the Office of Administration.
2. **"CONSTRUCTION DOCUMENTS":** The "Construction Documents" shall consist of the Project Manual, Drawings and Addenda.
3. **"CONSTRUCTION REPRESENTATIVE:"** Whenever the term "Construction Representative" is used, it shall mean the Owner's Representative at the work site.
4. **"CONTRACTOR"**: Party or parties who have entered into a contract with the Owner to furnish work under these specifications and drawings.
5. **"DESIGNER"**: When the term "Designer" is used herein, it shall refer to the Architect, Engineer, or Consultant of Record specified and defined in Paragraph 2.0 of the Supplemental Conditions, or his duly authorized representative. The Designer may be either a consultant or state employee.
6. **"DIRECTOR"**: Whenever the term "Director" is used, it shall mean the Director of the Division of Facilities Management, Design and Construction or his Designee, representing the Office of Administration, State of Missouri. The Director is the agent of the Owner.
7. **"DIVISION":** Shall mean the Division of Facilities Management, Design and Construction, State of Missouri.
8. **"INCIDENTAL JOB BURDENS":** Shall mean those expenses relating to the cost of work, incurred either in the home office or on the job-site, which are necessary in the course of doing business but are incidental to the job. Such costs include office supplies and equipment, postage, courier services, telephone expenses including long distance, water and ice and other similar expenses.
9. **"JOINT VENTURE"**: An association of two (2) or more businesses to carry out a single business enterprise for profit for which purpose they combine their property, capital, efforts, skills and knowledge.
10. **"OWNER"**: Whenever the term "Owner" is used, it shall mean the State of Missouri. Acting by and through the Office of Administration, Division of Facilities Management, Design and Construction.
11. **"PROJECT"**: Wherever the term "Project" is used, it shall mean the work required to be completed by the construction contract.
12. **"PROJECT MANUAL"**: The "Project Manual" shall consist of Introductory Information, Invitation for Bid, Instructions to Bidders, Bid Documents, Additional Information, Standard Forms, General Conditions, Supplemental General Conditions, General Requirements and Technical Specifications.
13. **"SUBCONTRACTOR"**: Party or parties who contract under, or for the performance of part or this entire Contract between the Owner and Contractor. The subcontract may or may not be direct with the Contractor.
14. **"WORK"**: All supervision, labor, materials, tools, supplies, equipment, and any incidental operations and/or activities required by or reasonably inferable from the Contract Documents necessary to construct the Project and to produce the results intended by the Contract Documents in a safe, expeditious, orderly, and workmanlike manner so that the project shall be complete and finished in the best manner known to each respective trade.
15. "**WORKING DAYS**": are all calendar days except Saturdays, Sundays and the following holidays: New Year's Day, Martin Luther King, Jr. Day, Lincoln Day, Washington's Birthday (observed), Truman Day, Memorial Day, Juneteenth, Independence Day, Labor Day, Columbus Day, Veterans Day (observed), Thanksgiving Day, Christmas Day.

ARTICLE 1.2 DRAWINGS AND SPECIFICATIONS

A. In case of discrepancy between drawings and specifications, specifications shall govern. Should discrepancies in architectural drawings, structural drawings and mechanical drawings occur, architectural drawings shall govern and, in case of conflict between structural and mechanical drawings, structural drawings shall govern.

B. Specifications are separated into titled divisions for convenience of reference only and to facilitate letting of contracts and subcontracts. The Contractor is responsible for establishing the scope of work for subcontractors, which may cross titled divisions. Neither the Owner nor Designer will establish limits and jurisdiction of subcontracts.

C. Figured dimensions take precedence over scaled measurements and details over smaller scale general drawings. In the event of conflict between any of the documents contained within the contract, the documents shall take precedence and be controlling in the following sequence: addenda, supplementary general conditions, general conditions, division 1 specifications, technical division specifications, drawings, bid form and instructions to bidders.

D. Anything shown on drawings and not mentioned in these specifications or vice versa, as well as any incidental work which is obviously necessary to complete the project within the limits established by the drawings and specifications, although not shown on or described therein, shall be performed by the Contractor at no additional cost as a part of his contract.

E. Upon encountering conditions differing materially from those indicated in the contract documents, the Contractor shall promptly notify the Designer and Construction Representative in writing before such conditions are disturbed. The Designer shall promptly investigate said conditions and report to the Owner, with a recommended course of action**.** If conditions do materially differ and cause an increase or decrease in contract cost or time required for completion of any portion of the work, a contract change will be initiated as outlined in Article 4 of these General Conditions.

E. Only work included in the contract documents is authorized, and the Contractor shall do no work other than that described therein or in accordance with appropriately authorized and approved contract changes.

ARTICLE 1.3 - COMPLIANCE WITH LAWS, PERMITS, REGULATIONS AND INSPECTIONS

A. Since the Owner is the State of Missouri, municipal or political subdivisions, zoning ordinances, construction codes (other than licensing of trades), and other like ordinances are not applicable to construction on Owner's property, and Contractor will not be required to submit drawings and specifications to any municipal or political subdivision, authority, obtain construction permits or any other licenses (other than licensing of trades) or permits from or submit to inspections by any municipality or political subdivision relating to the construction for this project. All permits or licenses required by municipality or political subdivision for operation on property not belonging to Owner shall be obtained by and paid for by Contractor. Each Contractor shall comply with all applicable laws, ordinances, rules and regulations that pertain to the work of this contract.

B. Contractors, subcontractors and their employees engaged in the businesses of electrical, mechanical, plumbing, carpentry, sprinkler system work, and other construction related trades shall be licensed to perform such work by the municipal or political subdivision where the project is located, if such licensure is required by local code. Local codes shall dictate the level (master, journeyman, and apprentice) and the number, type and ratio of licensed tradesmen required for this project within the jurisdiction of such municipal or political subdivision.

C. Equipment and controls manufacturers and their authorized service and installation technicians that do not maintain an office within the jurisdiction of the municipal or political subdivision but are a listed or specified contractor or subcontractor on this project are exempt from Paragraph 1.3 B above.

D. The Contractor shall post a copy of the wage determination issued for the project and included as a part of the contract documents, in a prominent and easily accessible location at the site of construction for the duration of the project.

E. Any contractor or subcontractor to such contractor at any tier signing a contract to work on this project shall provide a ten-hour Occupational Safety and Health Administration (OSHA) construction safety program for their on-site employees which includes a course in construction safety and health approved by OSHA or a similar program approved by the Department of Labor and Industrial Relations which is at least as stringent as an approved OSHA program. The contractor shall forfeit as a penalty to the public body on whose

behalf the contract is made or awarded, two thousand five hundred dollars plus one hundred dollars for each employee employed by the contractor or subcontractor, for each calendar day, or portion thereof, such employee is employed without the required training.

ARTICLE 1.4 - NONDISCRIMINATION IN EMPLOYMENT

A. The Contractor and his subcontractors will not discriminate against individuals based on race, color, religion, national origin, sex, disability, or age, but may use restrictions which relate to bona fide occupational qualifications. Specifically, the Contractor and his subcontractors shall not discriminate:

1. Against recipients of service on the basis of race, color, religion, national origin, sex, disability or age.
2. Against any employee or applicant, for employment on the basis of race, color, religion, national origin, sex or otherwise qualified disability status.
3. Against any applicant for employment or employee on the basis of age, where such applicant or employee is between ages 40 and 70 and where such Contractor employs at least 20 persons.
4. Against any applicant for employment or employee on the basis of that person's status as a disabled or Vietnam-era veteran.

The Contractor and his Subcontractors will ensure applicants for employment and employees are treated equally without regard to race, color, religion, national origin, sex, disability, or age. Such action shall include, but not be limited to, the following: employment, upgrading, demotion and transfer; recruitment or recruitment advertising; and selection for training, including apprenticeship. The Contractor and his Subcontractors will give written notice of their commitments under this clause to any labor union with which they have bargaining or other agreements under this clause to any labor union with which they have bargaining or other agreements.

B. In the event of the Contractor's or his subcontractor's noncompliance with any provisions of this Article of the Contract, the Owner may cancel this contract in whole or in part or require the Contractor to terminate his contract with the subcontractor.

ARTICLE 1.5 - ANTI-KICKBACK

No employee of the division, shall have or acquire any pecuniary interest, whether direct or indirect, in this contract or in any part hereof. No officer, employee, designer, attorney, or administrator of or for the Owner who is authorized in such capacity and on behalf of the Owner to exercise any legislative, executive, supervisory or other similar functions in connection with the construction of the project, shall have or acquire any pecuniary interest, whether direct or indirect, in this contract, any material supply contract, subcontract, insurance contract, or any other contract pertaining to the project.

ARTICLE 1.6 - PATENTS AND ROYALTIES

A. The Contractor shall hold and save the Owner and its officers, agents, servants, and employees harmless from liabilities of any nature or kind, including cost and expenses, for, or on account of, any patented or unpatented invention, process, article or appliance manufactured or used in the performance of this contract, including its use by the Owner, unless otherwise specifically stipulated in the contract documents.

B. If the Contractor uses any design, device or materials covered by letters, patent or copyright, the Contractor shall provide for such use by suitable agreement with the Owner of such patented or copyrighted design, device or material. It is mutually agreed and understood, without exception, that the contract prices shall include all royalties or costs arising from the use of such design, device or materials, in any way involved in the work. The Contractor and/or his sureties shall indemnify and save harmless the Owner of the project from any and all claims for infringement by reason of the use of such patented or copyrighted design, device or materials or any trademark or copyright in connection with work agreed to be performed under this contract and shall indemnify the Owner for any cost, expense or damage it may be obliged to pay by reason of such infringement at any time during the prosecution of the work or after completion of the work.

ARTICLE 1.7 - PREFERENCE FOR AMERICAN AND MISSOURI PRODUCTS AND SERVICES

A. By virtue of statutory authority a preference will be given to Missouri labor and to products of mines, forests and quarries of the state of Missouri when they are found in marketable quantities in the state, and all such materials shall be of the best quality and suitable character that can be obtained at reasonable market prices, all as provided for in Section 8.280, Missouri Revised Statutes and Cumulative Supplements.

B. Furthermore, pursuant to Section 34.076 Missouri Revised Statutes and Cumulative Supplements, a preference shall be given to those persons doing business as Missouri firms, corporations, or individuals, or which maintain Missouri offices or places of business, when the quality of performance promised is equal or better and the price quoted is the same or less. In addition, in order for a non-domiciliary bidder to be successful, his bid must be that same percentage lower than a domiciliary Missouri bidder's bid, as would be required for a Missouri bidder to successfully bid in the non-domiciliary state.

C In accordance with the Missouri Domestic Products Procurement Act Section 34.350 RSMo and Cumulative Supplements any manufactured goods or commodities used or supplied in the performance of this contract or any subcontract thereto shall be manufactured, assembled or produced in the United States, unless the specified products are not manufactured, assembled or produced in the United States in sufficient quantities to meet the agency's requirements or cannot be manufactured, assembled or produced in the United States within the necessary time in sufficient quantities to meet the contract requirements, or if obtaining the specified products manufactured, assembled or produced in the United States would increase the cost of this contract for purchase of the product by more than ten percent.

ARTICLE 1.8 - COMMUNICATIONS

A. All notices, requests, instructions, approvals, and claims must be in writing and shall be delivered to the Designer and copied to the Construction Representative for the project except as required by Article 1.12 Disputes and Disagreements, or as otherwise specified by the Owner in writing as stated in Section 012600. Any such notice shall be deemed to have been given as of the time of actual receipt.

B. The Contractor shall attend on-site progress and coordination meetings, as scheduled by the Construction Representative, no less than once a month.

C. The Contractor shall ensure that major subcontractors and suppliers shall attend monthly progress meetings as necessary to coordinate the work, and as specifically requested by the Construction Representative.

ARTICLE 1.9 - SEPARATE CONTRACTS AND COOPERATION

A. The Owner reserves the right to let other contracts in connection with this work. The Contractor shall afford other contractors reasonable opportunity for the introduction and storage of their materials and the execution of their work and shall properly connect and coordinate his work with theirs.

B. The Contractor shall consult the drawings for all other contractors in connection with this work. Any work conflicting with the above shall be brought to the attention of the Owner’s Representative before the work is performed. If the Contractor fails to do this, and constructs any work which interferes with the work of another contractor, the Contractor shall remove any part so conflicting and rebuild same, as directed by the Owner’s Representative at no additional cost to the Owner.

C. Each contractor shall be required to coordinate his work with other contractors so as to afford others reasonable opportunity for execution of their work. No contractor shall delay any other contractor by neglecting to perform contract work at the proper time. If any contractor causes delay to another, they shall be liable directly to that contractor for such delay in addition to any liquidated damages which might be due the Owner.

D. Should the Contractor or project associated subcontractors refuse to cooperate with the instructions and reasonable requests of other Contractors or other subcontractors in the overall coordinating of the work, the Owner may take such appropriate action and issue directions, as required, to avoid unnecessary and unwarranted delays.

E. Each Contractor shall be responsible for damage done to Owner's or other Contractor's property by him/her or workers in his employ through their fault or negligence.

F. Should a Contractor sustain any damage through any act or omission of any other Contractor having a contract with the Owner, the Contractor so damaged shall have no claim or cause of action against the Owner for such damage, but shall have a claim or cause of action against the other Contractor to recover any and all damages sustained by reason of the acts or omissions of such Contractor. The phrase "acts or omissions" as used in this section shall be defined to include, but

not be limited to, any unreasonable delay on the part of any such contractors.

ARTICLE 1.10 - ASSIGNMENT OF CONTRACT

A. No assignment by Contractor of any amount or any part of this contract or of the funds to be received there under will be recognized unless such assignment has had the written approval of the Director and the surety has been given due notice of such assignment and has furnished written consent thereto. In addition to the usual recitals in assignment contracts, the following language must be set forth: "It is agreed that the funds to be paid to the assignee under this assignment are subject to performance by the Contractor of this contract and to claims or liens for services rendered or materials supplied for the performance of the work called for in said contract in favor of all persons, firms or corporations rendering such services or supplying such materials."

ARTICLE 1.11 - INDEMNIFICATION

A. Contractor agrees to indemnify and save harmless Owner and its respective commissioners, officers, officials, agents, consultants and employees and Designer, their agents, servants and employees, from and against any and all liability for damage arising from injuries to persons or damage to property occasioned by any acts or omissions of Contractor, any subcontractors, agents, servants or employees, including any and all expense, legal or otherwise, which may be incurred by Owner or Designer, its agents, servants or employees, in defense of any claim, action or suit.

B. The obligations of the Contractor under this paragraph shall not extend to the liability of the Designer, his agents or employees, arising out of (1) the preparation or approval of maps, drawings, opinions, reports, surveys, contract changes, design or specifications, or (2) giving of or the failure to give directions or instructions by the Designer, his agents or employees as required by this contract documents provided such giving or failure to give is the primary cause of the injury or damage.

ARTICLE 1.12 - DISPUTES AND DISAGREEMENTS

It is hereby expressly agreed and understood that in case any controversy or difference of opinion arises during construction, best efforts will be given to resolution at the field level. Should those efforts be unsuccessful, the Contractor has the right to appeal in writing, the decision of the Director's Designee to the Director at Room 730 Truman Building, P.O. Box 809, Jefferson City, Missouri 65102. The decision of the Director shall be final and binding on all parties.

ARTICLE 2 -- OWNER/DESIGNER RESPONSIBILITIES

A. The Owner shall give all orders and directions contemplated under this contract relative to the execution of the work. During progress of work the Owner will be represented at the project site by the Construction Representative and/or Designer, whose responsibilities are to see that this contract is properly fulfilled.

B. The Owner shall at all times have access to the work whenever it is in preparation or progress. The Contractors shall provide proper facilities for such access and for inspection and supervision.

C. All materials and workmanship used in the work shall be subject to the inspection of the Designer and Construction Representative, and any work which is deemed defective shall be removed, rebuilt or made good immediately upon notice. The cost of such correction shall be borne by the Contractor. Contractor shall not be entitled to an extension of the contract completion date in order to remedy defective work. All rejected materials shall be immediately removed from the site of the work.

D. If the Contractor fails to proceed at once with the correction of rejected defective materials or workmanship, the Owner may, by separate contract or otherwise, have the defects remedied or rejected. Materials removed from the site and charge the cost of the same against any monies which may be due the Contractor, without prejudice to any other rights or remedies of the Owner.

E. Failure or neglect on the part of Owner to observe faulty work, or work done which is not in accordance with the drawings and specifications shall not relieve the Contractor from responsibility for correcting such work without additional compensation.

F. The Owner shall have the right to direct the Contractor to uncover any completed work.

1. If the Contractor fails to adequately notify the Construction Representative and/or Designer of an inspection as required by the Contract Documents, the Contractor shall, upon written request, uncover the work. The Contractor shall bear all costs associated with uncovering and again covering the work exposed.

2. If the Contractor is directed to uncover work, which was not otherwise required by the Contract Documents to be inspected, and the work is found to be defective in any respect, no compensation shall be allowed for this work. If, however, such work is found to meet

the requirements of this contract, the actual cost of labor and material necessarily involved in the examination and replacement plus 10% shall be allowed the Contractor.

G. The Designer shall give all orders and directions contemplated under this contract relative to the scope of the work and shall give the initial interpretation of the contract documents.

H. The Owner may file a written notice to the Contractor to dismiss immediately any subcontractors, project managers, superintendents, foremen, workers, watchmen or other employees whom the Owner may deem incompetent, careless or a hindrance to proper or timely execution of the work. The Contractor shall comply with such notice as promptly as practicable without detriment to the work or its progress.

I. If in the Owner's judgment it becomes necessary at any time to accelerate work, when ordered by the Owner in writing, the Contractor shall redirect resources to such work items and execute such portions of the work as may be required to complete the work within the current approved contract schedule.

ARTICLE 3 -- CONTRACTOR RESPONSIBILITIES

The Contractor shall register and utilize the Owner's eBuilder digital project management system for submission of documents described in the following sections. This includes but is not limited to submittals as required by designer, payment applications, Request for Information (RFI), construction change orders, Request for Proposals (RFP), Designer Supplemental Instructions (DSI), etc.

ARTICLE 3.1 -- ACCEPTABLE SUBSTITUTIONS

A. The Contractor may request use of any article, device, product, material, fixture, form or type of construction which in the judgment of the Owner and Designer is equal in all respects to that named. Standard products of manufacturers other than those specified will be accepted when, prior to the ordering or use thereof, it is proven to the satisfaction of the Owner and Designer that they are equal in design, strength, durability, usefulness and convenience for the purpose intended.

B. Any changes required in the details and dimensions indicated on the drawings for the substitution of products other than those specified shall be properly made at the expense of the Contractor requesting the substitution or change.

C. The Contractor shall submit a request for such substitutions in writing to the Owner and Designer within twenty (20) working days after the date of the "Notice to Proceed." Thereafter no consideration will be given to alternate forms of accomplishing the work. This Article does not preclude the Owner from exercising the provisions of Article 4 hereof.

D. Any request for substitution by the Contractor shall be submitted in accordance with SECTION 002113 - INSTRUCTIONS TO BIDDERS.

E. When a material has been approved, no change in brand or make will be permitted unless:

1. Written verification is received from the manufacturer stating they cannot make delivery on the date previously agreed, or
2. Material delivered fails to comply with contract requirements.

ARTICLE 3.2 -- SUBMITTALS

A. The Contractor's submittals must be submitted with such promptness as to allow for review and approval so as not to cause delay in the work. The Contractor shall coordinate preparation and processing of submittals with performance of construction activities.

Coordinate each submittal with fabrication, = purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

Submit four (4) copies to the Designer and additional copies as required for the subcontractors and material suppliers. Also provide copies to meet the requirements for maintenance manuals.

B. All subcontractors' shop drawings and schedules shall be submitted by the Contractor and shall bear evidence that Contractor has received, reviewed, and approved them. Any shop drawings and schedules submitted without this evidence will be returned to the Contractor for resubmission.

C. The Contractor shall include with the shop drawing, a letter indicating any and all deviations from the drawings and/or specifications. Failure to notify the Designer of such deviations will be grounds for subsequent rejection of the related work or materials. If, in the opinion of the Designer, the deviations are not acceptable, the Contractor will be required to furnish the item as specified and indicated on the drawings.

D. The Designer shall check shop drawings and schedules with reasonable promptness and approve them only if they conform to the design concept of the project and comply with the information given in the contract documents. The approval shall not relieve the Contractor from the responsibility to comply with the drawings and specifications, unless the Contractor has called the Designer's attention to the deviation, in writing, at the time of

submission and the Designer has knowingly approved thereof. An approval of any such modification will be given only under the following conditions:

1. It is in the best interest of the Owner
2. It does not increase the contract sum and/or completion time
3. It does not deviate from the design intent
4. It is without prejudice to any and all rights under the surety bond.

E. No extension of time will be granted because of the Contractor's failure to submit shop drawings and schedules in ample time to allow for review, possible resubmission, and approval. Fabrication of work shall not commence until the Contractor has received approval. The Contractor shall furnish prints of approved shop drawings and schedules to all subcontractors whose work is in any way related to the work under this contract. Only prints bearing this approval will be allowed on the site of construction

F. The Contractor shall maintain a complete file on-site of approved shop drawings available for use by the Construction Representative.

ARTICLE 3.3 – AS-BUILT DRAWINGS

A. The Contractor shall update a complete set of the construction drawings, shop drawings and schedules of all work monthly by marking changes, and at the completion of their work (prior to submission of request for final payment) note all changes and turn the set over to the Construction Representative. The updates shall show all addenda, all field changes that were made to adapt to field conditions, changes resulting from contract changes or supplemental instructions, and all locations of structures, buried installations of piping, conduit, and utility services. All buried and concealed items both inside and outside shall be accurately located as to depth and referenced to permanent features such as interior or exterior wall faces and dimensions shall be given in a neat and legible manner in a contrasting colored pencil or ink. If approved by the Designer, an electronic file format may be provided.

ARTICLE 3.4 – GUARANTY AND WARRANTIES

A. General Guaranty

1. Neither the final certificate of payment nor any provision in the contract documents nor partial use or occupancy of the premises by the Owner shall constitute an acceptance of work not done in accordance with contract requirements.
2. The Contractor or surety shall remedy any defects in the work and pay for any damage to property resulting there from which shall appear within a period of one (1) year from the date of substantial completion unless a longer period is otherwise specified or a differing guaranty period has been established in the substantial completion certificate. The Owner will give notice of observed defects with reasonable promptness.
3. In case of default on the part of the Contractor in fulfilling this part of this contract, the Owner may correct the work or repair the damage and the cost and expense incurred in such event shall be paid by or recoverable from the Contractor or surety.
4. The work will be free from defects not inherent in the quality required or permitted, and that the Work will conform to the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The Contractor's guaranty excludes remedy for damage or defect caused by abuse, modifications not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage. If required by the Owner, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment

B. Extended Warranty

Manufacturer's certificates of warranty shall be obtained for all major equipment. Warranty shall be obtained for at least one year. Where a longer period is offered at no additional cost or called for in the specific equipment specifications, the longer period shall govern.

ARTICLE 3.5 -- OPERATION AND MAINTENANCE MANUALS

A. Immediately after equipment submittals are approved and no later than ten (10) working days prior to the substantial completion inspection, the Contractor shall provide to the Designer three (3) copies of operating instructions and service manuals, containing the following:

1. Start-up and Shut-down Procedures: Provide a step-by-step write up of all major equipment. When manufacturer’s printed start-up, trouble shooting and shut-down procedures are available; they may be incorporated into the operating manual for reference.

2. Operating Instructions: Written operating instructions shall be included for the efficient and safe operation of all equipment.

3. Equipment List: List of all major equipment as installed shall be prepared to include model number, capacities, flow rate, name place data, shop drawings and air and water balance reports.

4. Service Instructions: Provide the following information for all pieces of equipment.

   a. Recommended spare parts including catalog number and name of local supplier or factory representative.

   b. Belt sizes, types, and lengths.

   c. Wiring diagrams.

5. Manufacturer's Certificate of Warranty as described in Article 3.4.

6. Prior to the final payment, furnish to the Designer three (4) copies of parts catalogs for each piece of equipment furnished by him/her on the project with the components identified by number for replacement ordering.

B. Submission of operating instructions shall be done in the following manner.

1. Manuals shall be in quadruplicate, and all materials shall be bound into volumes of standard 8½" x 11" hard binders. Large drawings too bulky to be folded into 8½" x 11" shall be separately bound or folded and in envelopes, cross referenced and indexed with the manuals.

2. The manuals shall identify project name, project number, and include the name and address of the Contractor, subcontractors and manufacturers who were involved with the activity described in that particular manual.

3. Internally subdivide the binder contents with permanent page dividers, logically organized with tab titles clearly printed under reinforced laminated plastic tabs.

4. Contents: Prepare a Table of Contents for each volume, with each product or system description identified.

ARTICLE 3.6 – OTHER CONTRACTOR RESPONSIBILITIES

A. The Contractor shall keep on site, during progress of the work, a competent superintendent satisfactory to the Construction Representative. The superintendent shall represent the Contractor and all agreements made by the superintendent shall be binding. The superintendent shall carefully study and compare all drawings, specifications and other instructions and shall promptly notify the Construction Representative and Designer, in writing, any error, inconsistency or omission which may be discovered. The superintendent shall coordinate all work on the project. Any change of the superintendent shall be approved by the Construction Representative.

B. Contractor shall, at all times, enforce strict discipline and good order among his employees, and shall not employ on the work any unfit person or anyone not skilled in the work assigned to him/her.

C. The Contractor shall supply sufficient labor, material, plant and equipment and pay when due any laborer, subcontractor or supplier for supplies furnished and otherwise prosecute the work with diligence to prevent work stoppage and ensure completion thereof within the time specified.

D. The Contractor and each of his subcontractors shall submit to the Construction Representative, through the Designer such schedules of quantities and costs, progress schedules, payrolls, reports, estimates, records and other data as the Owner may request concerning work performed or to be performed under this contract.

E. The Contractor, subcontractors, and material suppliers shall upon written request, give the Owner access to all time cards, material invoices, payrolls, estimates, profit and loss statements, and all other direct or indirect costs related to this work.

F. The Contractor shall be responsible for laying out all contract work such as layout of architectural, structural, mechanical and electrical work, which shall be coordinated with layouts of subcontractors for general construction work. The Contractor is also responsible for unloading, uncrating and handling of all materials and equipment to be erected or placed by him/her, whether furnished by Contractor or others. No extra charges or compensation will be allowed as a result of failure to verify dimensions before ordering materials or fabricating items.

G. The Contractor must notify the Construction Representative at least one working day before placing concrete or burying underground utilities, pipelines, etc.

H. Contractors shall prearrange time with the Construction Representative for the interruption of any facility operation. Unless otherwise specified in these documents, all connections, alterations or relocations as well as all other portions of the work will be performed during normal working hours.

I. The Contractor shall coordinate all work so there will not be prolonged interruptions of existing equipment operation. Any existing plumbing, heating, ventilating, air conditioning or electrical disconnections necessary for the project, which affect portions of this construction or building or any other building must be scheduled with the Construction Representative to minimize or avoid any disruption of facility operations. In no case, unless previously approved in writing by the Construction Representative, shall utilities be left disconnected at the end of a work day or over a weekend. Any interruption of utilities either intentionally or accidentally shall not relieve the Contractor responsible for the interruption from the responsibility to repair and restore the utility to normal service. Repairs and restoration shall be made before the workers responsible for the repair and restoration leave the job.

J. Contractors shall limit operations and storage of materials to the area within the project, except as necessary to connect to existing utilities, and shall not encroach on neighboring property. The Contractor shall be responsible for repair of their damage to property on or off the project site occurring during construction of project. All such repairs shall be made to the satisfaction of the property owner.

K. Unless otherwise permitted, all materials shall be new and both workmanship and materials shall be of the best quality.

L. Unless otherwise provided and stipulated within these specifications, the Contractor shall furnish, construct, and/or install and pay for materials, devices, mechanisms, equipment, all necessary personnel, utilities including, but not limited to water, heat, light and electric power, transportation services, applicable taxes of every nature, and all other facilities necessary for the proper execution and completion of the work.

M. Contractor shall carefully examine the plans and drawings and shall be responsible for the proper fitting of his material, equipment and apparatus into the building.

N. The Contractor or subcontractors shall not overload, or permit others to overload, any part of any structure during the performance of this contract.

O. All temporary shoring, bracing, etc., required for the removal of existing work and/or for the installation of new work shall be included in this contract. The Contractor shall make good, at no cost to the Owner, any damage caused by improper support or failure of shoring in any respect. Each Contractor shall be responsible for shoring required to protect his work or adjacent property and improvements of Owner and shall be responsible for shoring or for giving written notice to adjacent property owners. Shoring shall be removed only after completion of permanent supports.

P. The Contractor shall provide at the proper time such material as is required for support of the work. If openings are required, whether shown on drawings or not, the Contractor shall see that they are properly constructed.

Q. During the performance of work the Contractor shall be responsible for providing and maintaining warning signs, lights, signal devices, barricades, guard rails, fences and other devices appropriately located on site which will give proper and understandable warning to all persons of danger of entry onto land, structure or equipment.

R. The Contractor shall be responsible for protection, including weather protection, and proper maintenance of all equipment and materials.

S. The Contractor shall be responsible for care of the finished work and shall protect same from damage or defacement until substantial completion by the Owner. If the work is damaged by any cause, the Contractor shall immediately begin to make repairs in accordance with the drawings and specifications. Contractor shall be liable for all damage or loss unless attributable to the acts or omissions of the Owner or Designer. Any claim for reimbursement shall be submitted in accordance with Article 4. After substantial completion the Contractor will only be responsible for damage resulting from acts or omissions of the Contractor or subcontractors through final warranty.

T. In the event the Contractor encounters an unforeseen hazardous material, the Contractor shall immediately stop work in the area affected and report the condition to the Owner and Designer in writing. The Contractor shall not be required, pursuant to Article 4, to perform, any work relating to hazardous materials.

U. In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 4.

V. Before commencing work, Contractors shall confer with the Construction Representative and facility representative and review any facility rules and regulations which may affect the conduct of the work.

W. Project signs will only be erected on major projects and only as described in the specifications. If no sign is specified, none shall be erected.

ARTICLE 3.7 -- SUBCONTRACTS

A. Subcontractor assignments as identified in the bid form shall not be changed without written approval of the Owner. The Owner will not approve changes of a listed subcontractor unless the Contractor documents, to the satisfaction of the Owner that the subcontractor cannot or will not perform the work as specified.

B. The Contractor is fully responsible to the Owner for the acts and omissions of all subcontractors and of persons either directly or indirectly employed by them.

C. Every subcontractor shall be bound by the applicable terms and provisions of these contract documents, but no contractual relationship shall exist between any subcontractor and the Owner unless the right of the Contractor to proceed with the work is suspended or this contract is terminated as herein provided, and the Owner in writing elects to assume the subcontract.

D. The Contractor shall upon receipt of "Notice to Proceed" and prior to submission of the first payment request, notify the Designer and Construction Representative in writing of the names of any subcontractors to be used in addition to those identified in the bid form and all major material suppliers proposed for all parts of the work.

ARTICLE 4 -- CHANGES IN THE WORK

4.1 CHANGES IN THE WORK

A. The Construction Representative, without giving notice to the surety and without invalidating this contract, may order extra work or make changes by altering, adding to or deducting from the work, this contract sum being adjusted accordingly. All such work shall be executed under the conditions of the original contract. A claim for extension of time caused by any change must be adjusted at the time of ordering such change. No future request for time will be considered.

B. Each Contract Change shall include all costs required to perform the work including all labor, material, equipment, overheads and profit, delay, disruptions, or other miscellaneous expenses. No subsequent requests for additional compensation including claims for delay, disruption, or reduced efficiency as a result of each change will be considered. Values from the Schedule of Values will not be binding as a basis for additions to or deductions from the contract price.

C. The amount of any adjustment in this contract price for authorized changes shall be agreed upon before such changes become effective and shall be determined, through submission of a request for proposal, as follows:

1. By an acceptable fixed price proposal from the Contractor. Breakdowns shall include all takeoff sheets of each Contractor and subcontractor. Breakdown shall include a listing of each item of material with unit prices and number of hours of labor for each task. Labor costs per hour shall be included with labor burden identified, which shall be not less than the prevailing wage rate, etc. Overhead and profit shall be shown separately for each subcontractor and the Contractor.

2. By a cost-plus-fixed-fee (time and material) basis with maximum price, total cost not to exceed said maximum. Breakdown shall include a listing of each item of material with unit prices and number of hours of labor for each task. Labor costs per hour shall be included with labor burden identified, which shall be not less than the prevailing wage rate, etc. Overhead and profit shall be shown separately for each subcontractor and the Contractor.

3. By unit prices contained in Contractor's original bid form and incorporated in the construction contract.

D. Overhead and Profit on Contract Changes shall be applied as follows:

1. The overhead and profit charge by the Contractor and all subcontractors shall be considered to include, but is not limited to: incidental job burdens, small truck (under 1 ton) expense, mileage, small hand tools, warranty costs, company benefits and general office overhead. Project supervision including field supervision and job site office expense shall be considered a part of overhead and profit unless a compensable time extension is granted.

2. The percentages for overhead and profit charged on Contract Changes shall be subject to the following limits: (a) the percentage mark-up for the Contractor shall be limited to the Contractor’s fee: (b) fifteen percent (15%) maximum for Work directly performed by employees of a subcontractor, or sub-subcontractor; (c) five percent (5%) maximum for the Work performed or passed through to the Owner by the Contractor; (d) five percent (5%) maximum subcontractor’s mark-up for

Work performed by a sub-subcontractor and passed through to the Owner by the subcontractor and Contractor; and (e) in no case shall the total overhead and profit paid by the Owner on any Contract Changes exceed twenty-five percent (25%) of the cost of materials, labor and equipment (exclusive of Contractor or any Subcontractor overhead and profit) necessary to put the contract change work in place.

3. The Contractor will be allowed to add the cost of Contractor's payment and performance bonding, builder's risk insurance, and general liability insurance to their cost of work. The above listed bonding and insurance cost shall not exceed two percent (2%) and shall be allowed on the total cost of the added work, including overhead and profit.

4. On proposals covering both increases and decreases in the amount of this contract, the application of overhead and profit shall be on the net change in the cost of the work.

5. The percentage(s) for overhead and profit to be credited to the Owner on Contract Changes that are solely decreases in the quantity of work or materials shall be the same as those for additive Contract Changes provided above.

E. No claim for an addition to this contract sum shall be valid unless authorized as aforesaid in writing by the Owner. In the event that none of the foregoing methods are agreed upon, the Owner may order the Contractor to perform work on a time and material basis. The cost of such work shall be determined by the Contractor's actual labor and material cost to perform the work plus overhead and profit as outlined herein. The Designer and Construction Representative shall approve the Contractor's daily time and material invoices for the work involved.

F. If the Contractor claims that any instructions involve extra cost under this contract, the Contractor shall give the Owner's Representative written notice thereof within a reasonable time after the receipt of such instructions, and in any event before proceeding to execute the work. No such claim shall be valid unless so made and authorized by the Owner, in writing.

G. In an emergency affecting the safety of life or of the structure or of adjoining property, the Contractor, without special instruction or authorization from the Construction Representative, is hereby permitted to act at their discretion to prevent such threatened loss or injury. The Contractor shall submit a claim for compensation for such emergency work in writing to the Owner's Representative.

ARTICLE 4.2 – CHANGES IN COMPLETION TIME

A. Extension of the number of work days stipulated in the Contract for completion of the work with compensation may be made when:

1. The contractor documents that proposed Changes in the work, as provided in Article 4.1, extends construction activities critical to contract completion date, OR

2. The Owner suspends all work for convenience of the Owner as provided in Article 7.3, OR

3. An Owner caused delay extends construction activities critical to contract completion (except as provided elsewhere in these General Conditions). The Contractor is to review the work activities yet to begin and evaluate the possibility of rescheduling the work to minimize the overall project delay.

B. Extension of the number of work days stipulated in the Contract for completion of the work <u>without</u> compensation may be made when:

1. Weather-related delays occur, subject to provisions for the inclusion of a specified number of "bad weather" days when provided for in Section 012100-Allowances, OR

2. Labor strikes or acts of God occur, OR

3. The work of the Contractor is delayed on account of conditions which were beyond the control of the Contractor, subcontractors or suppliers, and were not the result of their fault or negligence.

C. No time extension or compensation will be provided for delays caused by or within the control of the Contractor, subcontractors or suppliers and for concurrent delays caused by the Owner.

D. The Contractor shall notify the Owner promptly of any occurrence or conditions which in the Contractor's opinion results in a need for an extension of time. The notice shall be in writing and shall include all necessary supporting materials with details of any resultant costs and be submitted in time to permit full investigation and evaluation of the Contractor's claim. The Owner shall promptly acknowledge the Contractor's notice and, after recommendation from the Owner's Representative and/or Designer, shall provide a decision to the Contractor. Failure on the part of the Contractor to provide such notice and to detail the costs shall constitute a waiver by the Contractor of any claim. Requests for extensions of time shall be for working days only.

ARTICLE 5 - CONSTRUCTION AND COMPLETION

ARTICLE 5.1 – CONSTRUCTION COMMENCEMENT

A. Upon receipt of the "Intent to Award" letter, the Contractor must submit the following properly executed instruments to the Owner:

1. Contract;
2. Performance/payment bond as described in Article 6.1;
3. Certificates of Insurance, or the actual policies themselves, showing that the Contractor has obtained the insurance coverage required by Article 6.2.

Above referenced items must be received by the Owner within ten (10) working days after the effective date of the contract. If not received, the Owner may treat the failure to timely submit them as a refusal by the Contractor to accept a contract for this work and may retain as liquidated damages the Contractor's bid bond, cashier's check or certified check as provided in the Instructions to Bidders. Upon receipt the Owner will issue a "Notice to Proceed" with the work to the Contractor.

B. Within the time frame noted in Section 013200 - Schedules, following receipt of the "Notice to Proceed", the Contractor shall submit to the Owner a progress schedule and schedule of values, showing activities through the end of the contract period. Should the Contractor not receive written notification from the Owner of the disapproval of the schedule of values within fifteen (15) working days, the Contractor may consider it approved for purpose of determining when the first monthly Application and Certification for Payment may be submitted.

C. The Contractor may commence work upon receipt of the Division of Facilities Management, Design and Construction's "Notice to Proceed" letter. Contractor shall prosecute the work with faithfulness and energy, and shall complete the entire work on or before the completion time stated in the contract documents or pay to the Owner the damages resulting from the failure to timely complete the work as set out within Article 5.4.

ARTICLE 5.2 -- PROJECT CONSTRUCTION

A. Each Contractor shall submit for the Owner's approval, in reproducible form, a progress schedule showing the rate of progress and the order of the work proposed to carry on various phases of the project. The schedule shall be in conformance with the requirements outlined in Section 013200 – Schedules.

B. Contractor shall employ and supply a sufficient force of workers, material, and equipment and shall pay when due, any worker, subcontractor or supplier and otherwise prosecute the work with such diligence so as to maintain the rate of progress indicated on the progress schedule, prevent work stoppage, and insure completion of the project within the time specified.

ARTICLE 5.3 -- PROJECT COMPLETION

A. Substantial Completion. A Project is substantially complete when construction is essentially complete and work items remaining to be completed can be done without interfering with the Owner's ability to use the Project for its intended purpose.

1. Once the Contractor has reached what they believe is Substantial Completion, the Contractor shall notify the Designer and the Construction Representative of the following:
   a. That work is essentially complete with the exception of certain listed work items. The list shall be referred to as the "Contractor's Punch."
   b. That all Operation and Maintenance Manuals have been assembled and submitted in accordance with Article 3.5A.
   c. That the Work is ready for inspection by the Designer and Construction Representative. The Owner shall be entitled to a minimum of ten working days notice before the inspection shall be performed.
2. If the work is acceptable, the Owner shall issue a Certificate of Substantial Completion, which shall set forth the responsibilities of the Owner and the Contractor for utilities, security, maintenance, damage to the work and risk of loss. The Certificate shall also identify those remaining items of work to be performed by the Contractor. All such work items shall be complete within 30 working days of the date of the Certificate, unless the Certificate specifies a different time. If the Contractor shall be required to perform tests that must be delayed due to climatic conditions, it is understood that such tests and affected equipment will be identified on the Certificate and shall be accomplished by the Contractor at the earliest possible date. Performance of the tests may not be required before Substantial Completion can be issued. The date of the issuance of the Certificate of

Substantial Completion shall determine whether or not the work was completed within the contract time and whether or not Liquidated Damages are due.

3. If the work is not acceptable, and the Owner does not issue a Certificate of Substantial Completion, the Owner shall be entitled to charge the Contractor with the Designer's and Owner's costs of re-inspection, including time and travel.

B. Partial Occupancy. Contractor agrees that the Owner shall be permitted to occupy and use any completed or partially completed portions of the Project, when such occupancy and use is in the Owner's best interest. Owner shall notify Contractor of its desire and intention to take Partial Occupancy as soon as possible but at least ten (10) working days before the Owner intends to occupy. If the Contractor believes that the portion of the work the Owner intends to occupy is not ready for occupancy, the Contractor shall notify the Owner immediately. The Designer shall inspect the work in accordance with the procedures above. If the Contractor claims increased cost of the project or delay in completion as a result of the occupancy, he shall notify the Owner immediately but in all cases before occupancy occurs.

C. Final Completion. The Project is finally complete when the Certificate of Substantial Completion has been issued and all work items identified therein as incomplete have been completed, and when all administrative items required by the contract have been completed. Final Completion entitles the Contractor to payment of the outstanding balance of the contract amount including all change orders and retainage. Within five (5) working days of the date of the Certificate of Substantial Completion, the Contractor shall identify the cost to complete any outstanding items of work. The Designer shall review the Contractor's estimate and either approve it or provide an independent estimate for all such items. If the Contractor fails to complete the remaining items within the time specified in the Certificate, the Owner may terminate the contract and go to the surety for project completion in accordance with Article 7.2 or release the contract balance to the Contractor less 150% of the approved estimate to complete the outstanding items. Upon completion of the outstanding items, when a final cost has been established, any monies remaining shall be paid to the Contractor. Failure to complete items of work does not relieve the Contractor from the obligation to complete the administrative requirements of the contract, such as the provisions of Article 5.3 FAILURE TO COMPLETE ALL ITEMS OF WORK UNDER THE CONTRACT SHALL BE CONSIDERED A DEFAULT AND BE GROUNDS FOR CONTRACT TERMINATION AND DEBARMENT.

D. Liquidated Damages. Contractor agrees that the Owner may deduct from the contract price and retain as liquidated damages, and not as penalty or forfeiture, the sum stipulated in this contract for each work day after the Contract Completion Day on which work is not Substantially Complete. Assessment of Liquidated Damages shall not relieve the Contractor or the surety of any responsibility or obligation under the Contract. In addition, the Owner may, without prejudice to any other rights, claims, or remedies the Owner may have including the right to Liquidated Damages, charge the Contractor for all additional expenses incurred by the Owner and/or Designer as the result of the extended contract period through Final Completion. Additional Expenses shall include but not be limited to the costs of additional inspections.

E. Early Completion. The Contractor has the right to finish the work before the contract completion date; however, the Owner assumes no liability for any hindrances to the Contractor unless Owner caused delays result in a time extension to the contract completion date. The Contractor shall not be entitled to any claims for lost efficiencies or for delay if a Certificate of Substantial Completion is given on or before the Contract Completion Date.

ARTICLE 5.4 -- PAYMENT TO CONTRACTOR

A. Payments on account of this contract will be made monthly in proportion to the work which has been completed. Request for payment must be submitted on the Owner's forms. No other pay request will be processed. Supporting breakdowns must be in the same format as Owner's forms and must provide the same level of detail. The Designer will, within 5 working days from receipt of the contractor's request for payment either issue a Certificate for Payment to the Owner, for such amount as the Designer determines is properly due, or notify the Contractor in writing of reasons for withholding a Certificate. The Owner shall make payment within 30 calendar days after the "Application and Certification for Payment" has been received and certified by the Designer. The following items are to be attached to the contractor's pay request:

1. Updated construction schedule
2. Certified payrolls consisting of name, occupation and craft, number of hours worked and actual wages paid for each individual employee, of the Contractor and all subcontractors working on the project

B. The Owner shall retain 5 percent of the amount of each such payment application, except as allowed by Article 5.4, until final completion and acceptance of all work covered by this contract.

C. Each payment made to Contractor shall be on account of the total amount payable to Contractor and all material and work covered by paid partial payment shall thereupon become the sole property of Owner. This provision shall not be construed as relieving Contractor from sole responsibility for care and protection of materials and work upon which payments have been made or restoration of any damaged work or as a waiver of the right of Owner to require fulfillment of all terms of this contract.

D. Materials delivered to the work site and not incorporated in the work will be allowed in the Application and Certification for Payment on the basis of one hundred (100%) percent of value, subject to the 5% retainage providing that they are suitably stored on the site or in an approved warehouse in accordance with the following requirements:

1. Material has previously been approved through submittal and acceptance of shop drawings conforming to requirements of Article 3.2 of General Conditions.

2. Delivery is made in accordance with the time frame on the approved schedule.

3. Materials, equipment, etc., are properly stored and protected from damage and deterioration and remain so - if not, previously approved amounts will be deleted from subsequent pay applications.

4. The payment request is accompanied by a breakdown identifying the material equipment, etc. in sufficient detail to establish quantity and value.

E. The Contractor shall be allowed to include in the Application and Certification for Payment, one hundred (100%) of the value, subject to retainage, of major equipment and material stored off the site if all of the following conditions are met:

1. The request for consideration of payment for materials stored off site is made at least 15 working days prior to submittal of the Application for Payment including such material. Only materials inspected will be considered for inclusion on Application for Payment requests.

2. Materials stored in one location off site are valued in excess of $25,000.

3. That a Certificate of Insurance is provided indicating adequate protection from loss, theft conversion or damage for materials stored off site. This Certificate shall show the State of Missouri as an additional insured for this loss.

4. The materials are stored in a facility approved and inspected, by the Construction Representative.

5. Contractor shall be responsible for, Owner costs to inspect out of state facilities, and any delays in the completion of the work caused by damage to the material or for any other failure of the Contractor to have access to this material for the execution of the work.

F. The Owner shall determine the amount, quality and acceptability of the work and materials which are to be paid for under this contract. In the event any questions shall arise between the parties, relative to this contract or specifications, determination or decision of the Owner or the Construction Representative and the Designer shall be a condition precedent to the right of the Contractor to receive any money or payment for work under this contract affected in any manner or to any extent by such question.

G. Payments Withheld: The Owner may withhold or nullify in whole or part any certificate to such extent as may be necessary to protect the Owner from loss on account of:

1. Defective work not remedied. When a notice of noncompliance is issued on an item or items, corrective action shall be undertaken immediately. Until corrective action is completed, no monies will be paid and no additional time will be allowed for the item or items. The cost of corrective action(s) shall be borne by the Contractor.

2. A reasonable doubt that this contract can be completed for the unpaid balance.

3. Failure of the Contractor to update as-built drawings monthly for review by the Construction Representative.

4. Failure of the Contractor to update the construction schedule.

When the Construction Representative is satisfied the Contractor has remedied above deficiencies, payment shall be released.

H. Final Payment: Upon receipt of written notice from the Contractor to the Designer and Project Representative that the work is ready for final inspection and acceptance, the Designer and Project Representative, with the Contractor, shall promptly make such inspection. If the work is acceptable and the contract fully performed, the Construction Representative shall complete a final acceptance report and the Contractor will be

directed to submit a final Application and Certification for Payment. If the Owner approves the same, the entire balance shall be due and payable, with the exception of deductions as provided for under Article 5.4.

1. Where the specifications provide for the performance by the Contractor of (certain tests for the purpose of balancing and checking the air conditioning and heating equipment and the Contractor shall have furnished and installed all such equipment in accordance with the specifications, but said test cannot then be made because of climatic conditions, such test shall may be considered as required under the provisions of the specifications, Section 013300 and this contract may be substantial Full payment will not be made until the tests have been made and the equipment and system is finally accepted. If the tests are not completed when scheduled, the Owner may deduct 150% of the value of the tests from the final payment.
2. The final payment shall not become due until the Contractor delivers to the Construction Representative:

    a) A complete file of releases, on the standard form included in the contract documents as "Final Receipt of Payment and Release Form", from subcontractors and material suppliers evidencing payment in full for services, equipment and materials, as the case may require, if the Owner approves, or a consent from the Surety to final payment accepting liability for any unpaid amounts.

    b) An Affidavit of Compliance with Prevailing Wage Law, in the form as included in this contract specifications, properly executed by each subcontractor, and the Contractor

    c) Certified copies of all payrolls

    d) As-built drawings

3. If any claim remains unsatisfied after all payments are made, the Contractor shall refund to the Owner all monies that the latter may be compelled to pay in discharging such a claim including all costs and a reasonable attorney's fee.
4. Missouri statute requires prompt payment from the Owner to the Contractor within thirty calendar days and from the Contractor to his subcontractors within fifteen calendar days. Failure to make payments within the required time frame entitles the receiving party to charge interest at the rate of one and one half percent per month calculated from the expiration of the statutory time period until paid.
5. The value of all unused unit price allowances and/or 150% of the value of the outstanding work items, and/or liquidated damages may be deducted from the final pay request without executing a Contract Change. Any unit price items which exceed the number of units in the contract may be added by Contract Change.

ARTICLE 6 -- INSURANCE AND BONDS

ARTICLE 6.1 -- BOND

A. Contractor shall furnish a performance/payment bond in an amount equal to 100% of the contract price to guarantee faithful performance of the contract and 100% of the contract price to guarantee the payment of all persons performing labor on the project and furnishing materials in connection therewith under this contract as set forth in the standard form of performance and payment bond included in the contract documents. The surety on such bond shall be issued by a surety company authorized by the Missouri Department of Insurance to do business in the state of Missouri.

B. All Performance/Payment Bonds furnished in response to this provision shall be provided by a bonding company with a rating of B+ or higher as established by A.M. Best Company, Inc. in their most recent publication.

ARTICLE 6.2 – INSURANCE

A. The successful Contractor shall procure and maintain for the duration of the contract issued a policy or policies of insurance for the protection of both the Contractor and the Owner and their respective officers, officials, agents, consultants and employees. The Owner requires certification of insurance coverage from the Contractor prior to commencing work.

B. Minimum Scope and Extent of Coverage

1. General Liability

Commercial General Liability, ISO coverage form number or equivalent CG 00 01 ("occurrence" basis), or I-SO coverage form number CG 00 02, or ISO equivalent.

If ISO equivalent or manuscript general liability coverage forms are used, minimum coverage will be as follows: Premises/Operations; Independent Contractors; Products/Completed Operations; personal Injury; Broad Form Property Damage including Completed Operations; Broad Form Contractual Liability Coverage to include Contractor's obligations under Article 1.11 Indemnification and any other Special Hazards required by the work of the contract.

2. Automobile Liability

Business Automobile Liability Insurance, ISO Coverage form number or equivalent CA 00 01 covering automobile liability, code 1 "ANY AUTO".

3. Workers' Compensation and Employer's Liability

Statutory Workers' Compensation Insurance for Missouri and standard Employer's Liability Insurance, or the authorization to self-insure for such liability from the Missouri Division of Workers' Compensation.

4. Builder's Risk or Installation Floater Insurance

Insurance upon the work and all materials, equipment, supplies, temporary structures and similar items which may be incident to the performance of the work and located at or adjacent to the site, against loss or damage from fire and such other casualties as are included in extended coverage in broad "All Risk" form, including coverage for Flood and Earthquake, in an amount not less than the replacement cost of the work or this contact price, whichever is greater, with loss payable to Contractor and Owner as their respective interests may appear.

Contractor shall maintain sufficient insurance to cover the full value of the work and materials as the work progresses, and shall furnish Owner copies of all endorsements. If Builder's Risk Reporting- Form of Endorsement is used, Contractor shall make all reports as required therein so as to keep in force an amount of insurance which will equal the replacement cost of the work, materials, equipment, supplies, temporary structures, and other property covered thereby; and if, as a result of Contractor's failure to make any such report, the amount of insurance so recoverable shall be less than such replacement cost, Contractor's interest in the proceeds of such insurance, if any, shall be subordinated to Owner's interest to the end that Owner may receive full reimbursement for its loss.

C. Minimum Limits of Insurance

1. General Liability

Contractor

$2,000,000	combined single limit per occurrence for bodily injury, personal injury, and property damage
$2,000,000	annual aggregate

2. Automobile Liability

$2,000,000	combined single limit per occurrence for bodily injury and property damage

3. Workers' Compensation and Employers Liability

Workers' Compensation limits as required by applicable State Statutes (generally unlimited) and minimum of $1,000,000 limit per accident for Employer's Liability.

General Liability and Automobile Liability insurance may be arranged under individual policies for the full limits required or by a combination of underlying policies with the balance provided by a form-following Excess or Umbrella Liability policy.

D. Deductibles and Self-Insured Retentions

All deductibles, co-payment clauses, and self-insured retentions must be declared to and approved by the Owner. The Owner reserves the right to request the reduction or elimination of unacceptable deductibles or self-insured retentions, as they would apply to the Owner, and their respective officers, officials, agents, consultants and employees. Alternatively, the Owner may request Contractor to procure a bond guaranteeing

payment of losses and related investigations, claims administration, and defense expenses.

E. Other Insurance Provisions and Requirements

The respective insurance policies and coverage, as specified below, must contain, or be endorsed to contain the following conditions or provisions:

1. General Liability

The Owner, and its respective commissioners, officers, officials, agents, consultants and employees shall be endorsed as additional insured's by ISO form CG 20 26 Additional Insured - Designated Person or Organization. As additional insured's, they shall be covered as to work performed by or on behalf of the Contractor or as to liability which arises out of Contractor's activities or resulting from the performance of services or the delivery of goods called for by the Contract.

Contractor's insurance coverage shall be primary with respect to all additional insured's. Insurance of self-insurance programs maintained by the designated additional -insured's shall be excess of the Contractor's insurance and shall not contribute with it.

Additionally, the Contractor and Contractor's general liability insurer shall agree to waive all rights of subrogation against the Owner and any of their respective officers, officials, agents, consultants or employees for claims, losses, or expenses which arise out of Contractor's activities or result from the performance of services or the delivery of goods called for by the Contract.

Contractor's failure to comply with the terms and conditions of these insurance policies shall not affect or abridge coverage for the Owner, or for any of their officers, officials, agents, consultants or employees.

2. Automobile Insurance

The Owner, and their respective officers, officials, agents, consultants and employees shall be endorsed as additional insured's by ISO form CG 20 26 - Additional Insured Designated Person or Organization. As additional insured's, they shall be covered as to work performed by or on behalf of the Contractor or as to liability which arises out of Contractor's activities or resulting from the performance of services or the delivery of goods called for by the Contract.

Contractor's insurance coverage shall be primary with respect to all additional insured's. Insurance or self-insurance programs maintained by the designated additional insured's shall be in excess of the Contractor's insurance and shall not contribute with it.

Additionally, the Contractor and Contractor's automobile insurer shall agree to waive all rights of subrogation against the Owner and any of their respective officers, officials, agents, consultants or employees for claims, losses, or expenses which arise out of Contractor's activities or result from the performance of services or the delivery of goods called for by the Contract.

Contractor's failure to comply with the terms and conditions of these insurance policies shall not affect or abridge coverage for the Owner or for any of its officers, officials, agents, consultants or employees.

3. Workers' Compensation/Employer's Liability

Contractor's workers' compensation insurance shall be endorsed with NCCI form WC 00 03 01 A - Alternative Employer Endorsement. The Alternative Employer Endorsement shall designate the Owner as "alternate employers."

4. All Coverages

Each insurance policy required by this section of the Contract shall contain a stipulation, endorsed if necessary, that the Owner will receive a minimum of a thirty (30) calendar day advance notice of any policy cancellation. Ten (10) calendar days advance notice is required for policy cancellation due to non-payment of premium.

F. Insurer Qualifications and Acceptability

Insurance required hereunder shall be issued by an A.M. Best, "B+" rated, Class IX insurance company approved to conduct insurance business in the state of Missouri.

G. Verification of Insurance Coverage

Prior to Owner issuing a Notice to Proceed, the Contractor-shall furnish the Owner with Certificate(s) of Insurance and with any applicable original endorsements evidencing the required insurance coverage. The insurance certificates and endorsements are to be signed by a person authorized by that insurer to bind coverage on its behalf. All certificates and endorsements received by the Owner are subject to review and approval by the Owner. The Owner reserves the right to require certified copies of all required policies at any time. If the scope of this contract will exceed one (1) year - or, if any of Contractor's applicable insurance coverage expires prior to completion of the work or services required under this contract -

the Contractor will provide a renewal or replacement certificate before continuing work or services hereunder. If the Contractor fails to provide documentation of required insurance coverage, the Owner may issue a stop work order and no additional contract completion time and/or compensation shall be granted as a result thereof.

ARTICLE 7 – SUSPENSION OR TERMINATION OF CONTRACT

ARTICLE 7.1 - FOR SITE CONDITIONS

When conditions at the site of the proposed work are considered by the Owner to be unsatisfactory for prosecution of the work, the Contractor may be ordered in writing to suspend the work or any part thereof until reasonable conditions exist. When such suspension is not due to fault or negligence of the Contractor, time allowed for completion of such suspended work will be extended by a period of time equal to that lost due to delay occasioned by ordered suspension. This will be a no cost time extension.

ARTICLE 7.2 - FOR CAUSE

A. Termination or Suspension for Cause:

1. If the Contractor shall file for bankruptcy, or should make a general assignment for the benefit of the creditors, or if a receiver should be appointed on account of insolvency, or if the contractor should persistently or repeatedly refuse or fail to supply enough properly skilled workers or proper materials, or if the contractor should fail to make prompt payment to subcontractors or for material or labor, or persistently disregard laws, ordinances or the instructions of the Owner, or otherwise be guilty of a substantial violation of any provision of this contract, then the Owner may serve notice on the Contractor and the surety setting forth the violations and demanding compliance with this contract. Unless within ten (10) consecutive calendar days after serving such notice, such violations shall cease and satisfactory arrangements for correction be made, the Owner may suspend the Contractor's right to proceed with the work or terminate this contract.

2. In the event the Owner suspends Contractor's right to proceed with the work or terminates the contract, the Owner may demand that the Contractor's surety take over and complete the work on this contract, after the surety submits a written proposal to the Owner and receives written approval and upon the surety's failure or refusal to do so within ten (10) consecutive calendar days after demand therefore, the Owner may take over the work and prosecute the same to completion by bid or negotiated contract, or the Owner may elect to take possession of and utilize in completing the work such materials, supplies, appliances and plant as may be on the site of the work, and all subcontractors, if the Owner elects, shall be bound to perform their contracts.

B. The Contractor and its surety shall be and remain liable to the Owner for any excess cost or damages occasioned to the Owner as a result of the actions above set forth.

C. The Contractor in the event of such suspension or termination shall not be entitled to receive any further payments under this contract until the work is wholly finished. Then if the unpaid balance under this contract shall exceed all expenses of the Owner as certified by the Director, such excess shall be paid to the Contractor; but, if such expenses shall exceed the unpaid balance as certified by the Director, the Contractor and their surety shall be liable for and shall pay the difference and any damages to the Owner.

D. In exercising Owner's right to secure completion of the work under any of the provisions hereof, the Director shall have the right to exercise Owner's sole discretion as to the manner, methods and reasonableness of costs of completing the work.

E. The rights of the Owner to suspend or terminate as herein provided shall be cumulative and not exclusive and shall be in addition to any other remedy provided by law.

F. The Contractor in the event of such suspension or termination may be declared ineligible for Owner contracts for a minimal period of twelve (12) months. Further, no contract will be awarded to any Contractor who lists in their bid form any subcontractor whose prior performance has contributed, as determined by the Owner, to a breach of a contract. In order to be considered for state-awarded contracts after this period, the Contractor/subcontractor will be required to forward acceptance reports to the Owner regarding successful completion of non-state projects during the intervening twelve (12) months from the date of default. No contracts will be awarded to a subcontractor/Contractor until the ability to perform responsibly in the private sector has been proven to the Owner.

ARTICLE 7.3 -- FOR CONVENIENCE

A. The Owner may terminate or suspend the Contract or any portion of the Work without cause at any time, and at the Owner's convenience. Notification of a termination or suspension shall be in writing

and shall be given to the Contractor and their surety. If the Contract is suspended, the notice will contain the anticipated duration of the suspension or the conditions under which work will be permitted to resume. If appropriate, the Contractor will be requested to demobilize and re-mobilize and will be reimbursed time and costs associated with the suspension.

B. Upon receipt of notification, the Contractor shall:

1. Cease operations when directed.

2. Take actions to protect the work and any stored materials.

3. Place no further subcontracts or orders for material, supplies, services or facilities except as may be necessary to complete the portion of the Contract that has not been terminated. No claim for payment of materials or supplies ordered after the termination date shall be considered.

4. Terminate all existing subcontracts, rentals, material, and equipment orders.

5. Settle all outstanding liabilities arising from termination with subcontractors and suppliers.

6. Transfer title and deliver to the Owner, work in progress, completed work, supplies and other material produced or acquire for the work terminated, and completed or partially completed plans, drawings information and other property that, if the Contract had been completed, would be required to be furnished to the Owner.

C. For termination without cause and at the Owner's convenience, in addition to payment for work completed prior to date of termination, the Contractor may be entitled to payment of other documented costs directly associated with the early termination of the contract. Payment for anticipated profit and unapplied overhead will not be allowed.

SECTION 007300 - SUPPLEMENTARY CONDITIONS

1.0 GENERAL:

A. These Supplementary General Conditions clarify, add, delete, or otherwise modify standard terms and conditions of DIVISION 0, BIDDING AND CONTRACTING REQUIREMENTS.

2.0 CONTACTS:

Designer:
Nick Gordon
Henderson Engineers, Inc.
8345 Lenexa Dr.
Lenexa, Kansas 66214
Telephone: (913) 742-5000
Email: nick.gordon@hendersonengineers.com

Construction Representative:
Carl Haley
Division of Facilities Management, Design and Construction
301 West High Street, Room 730
Jefferson City, Missouri 65101
Telephone: (573) 645-7834
Email: carl.haley@oa.mo.gov

Project Manager:
Shannon Thompson
Division of Facilities Management, Design and Construction
301 West High Street, Room 730
Jefferson City, Missouri 65101
Telephone: (573) 257-7137
Email: shannon.thompson@oa.mo.gov

Contract Specialist:
Paul Girouard
Division of Facilities Management, Design and Construction
301 West High Street, Room 730
Jefferson City, Missouri 65101
Telephone: (573) 751-4797
Email: Paul.Girouard@oa.mo.gov

3.0 NOTICE: ALL BID MATERIALS ARE DUE AT THE TIME OF BID SUBMITTAL. THERE IS NO SECOND SUBMITTAL FOR THIS PROJECT.

4.0 FURNISHING CONSTRUCTION DOCUMENTS:

A. The Owner will furnish the Contractor with approximately 5 complete sets of drawings and specifications at no charge.

B. The Owner will furnish the Contractor with approximately 5 sets of explanatory or change drawings at no charge.

C. The Contractor may make copies of the documents as needed with no additional cost to the Owner.

5.0 SAFETY REQUIREMENTS

Contractor and subcontractors at any tier shall comply with RSMo 292.675 and Article 1.3, E, of Section 007213, General Conditions.

Missouri
Division of Labor Standards
WAGE AND HOUR SECTION

MIKE KEHOE, Governor

Annual Wage Order No. 32

Section 014
CALLAWAY COUNTY

In accordance with Section 290.262 RSMo 2000, within thirty (30) days after a certified copy of this Annual Wage Order has been filed with the Secretary of State as indicated below, any person who may be affected by this Annual Wage Order may object by filing an objection in triplicate with the Labor and Industrial Relations Commission, P.O. Box 599, Jefferson City, MO 65102-0599. Such objections must set forth in writing the specific grounds of objection. Each objection shall certify that a copy has been furnished to the Division of Labor Standards, P.O. Box 449, Jefferson City, MO 65102-0449 pursuant to 8 CSR 20-5.010(1). A certified copy of the Annual Wage Order has been filed with the Secretary of State of Missouri.

Original Signed by
Logan Hobbs, Director
Division of Labor Standards

Filed With Secretary of State: **March 10, 2025**

Last Date Objections May Be Filed: **April 9, 2025**

Prepared by Missouri Department of Labor and Industrial Relations

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Asbestos Worker	$61.59
Boilermaker	$32.29*
Bricklayer-Stone Mason	$55.95
Carpenter	$56.66
Lather	
Linoleum Layer	
Millwright	
Pile Driver	
Cement Mason	$32.29*
Plasterer	
Communication Technician	$60.17
Electrician (Inside Wireman)	$60.36
Electrician Outside Lineman	$84.72
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Elevator Constructor	$32.29*
Glazier	$32.29*
Ironworker	**$72.72**
Laborer	$44.11
General Laborer	
First Semi-Skilled	
Second Semi-Skilled	
Mason	$32.29*
Marble Mason	
Marble Finisher	
Terrazzo Worker	
Terrazzo Finisher	
Tile Setter	
Tile Finisher	
Operating Engineer	$70.82
Group I	
Group II	
Group III	
Group III-A	
Group IV	
Group V	
Painter	$45.99
Plumber	$79.25
Pipe Fitter	
Roofer	$32.29*
Sheet Metal Worker	$57.78
Sprinkler Fitter	$69.30
Truck Driver	$45.31
Truck Control Service Driver	
Group I	
Group II	
Group III	
Group IV	

*The Division of Labor Standards received fewer than 1,000 reportable hours for this occupational title. The public works contracting minimum wage is established for this occupational title using data provided by Missouri Economic Research and Information Center.
**The Prevailing Hourly Rate includes any applicable fringe benefit amounts for each occupational title as defined in RSMo Section 290.210.

Heavy Construction Rates for
CALLAWAY County

Section 014

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Carpenter	$32.29*
Millwright	
Pile Driver	
Electrician (Outside Lineman)	$84.72
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Laborer	$53.25
General Laborer	
Skilled Laborer	
Operating Engineer	$76.26
Group I	
Group II	
Group III	
Group IV	
Truck Driver	$32.29*
Truck Control Service Driver	
Group I	
Group II	
Group III	
Group IV	

Use Heavy Construction Rates on Highway and Heavy construction in accordance with the classifications of construction work established in 8 CSR 30-3.040(3).

Use Building Construction Rates on Building construction in accordance with the classifications of construction work established in 8 CSR 30-3.040(2).

If a worker is performing work on a heavy construction project within an occupational title that is not listed on the Heavy Construction Rate Sheet, use the rate for that occupational title as shown on the Building Construction Rate Sheet.

*The Division of Labor Standards received fewer than 1,000 reportable hours for this occupational title. Public works contracting minimum wage is established for this occupational title using data provided by Missouri Economic Research and Information Center.

**The Prevailing Hourly Rate includes any applicable fringe benefit amounts for each occupational title.

OVERTIME
and
HOLIDAYS

OVERTIME

For all work performed on a Sunday or a holiday, not less than twice (2x) the prevailing hourly rate of wages for work of a similar character in the locality in which the work is performed or the public works contracting minimum wage, whichever is applicable, shall be paid to all workers employed by or on behalf of any public body engaged in the construction of public works, exclusive of maintenance work.

For all overtime work performed, not less than one and one-half (1½) the prevailing hourly rate of wages for work of a similar character in the locality in which the work is performed or the public works contracting minimum wage, whichever is applicable, shall be paid to all workers employed by or on behalf of any public body engaged in the construction of public works, exclusive of maintenance work or contractual obligation. For purposes of this subdivision, **"overtime work"** shall include work that exceeds ten hours in one day and work in excess of forty hours in one calendar week; and

A thirty-minute lunch period on each calendar day shall be allowed for each worker on a public works project, provided that such time shall not be considered as time worked.

HOLIDAYS

January first;
The last Monday in May;
July fourth;
The first Monday in September;
November eleventh;
The fourth Thursday in November; and
December twenty-fifth;

If any holiday falls on a Sunday, the following Monday shall be considered a holiday.

SECTION 011000 – SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. The Project consists of backup power equipment replacement.

1. Project Location: State of Missouri Fulton Reception and Diagnostic Center, Fulton, MO 65251.

2. Owner: State of Missouri, Office of Administration, Division of Facilities Management, Design and Construction, Harry S Truman State Office Building, Post Office Box 809, 301 West High Street, Jefferson City, Missouri 65102.

B. Contract Documents, dated May 30, 2025 were prepared for the Project by Henderson Engineers, 8345 Lenexa Drive, Suite 300, Lenexa KS 66214

C. The Work consists of backup power equipment replacement.

1. The Work includes:
a. Replacement of existing generator with new.
b. Replacement of existing day tank with new.
c. Replacement of existing backup power switchgear with new.
d. Replacement of existing automatic transfer switch with new.
e. Installation of new mobile generator connection tap box.

D. The Work will be constructed under a single prime contract.

1.3 WORK UNDER OTHER CONTRACTS (Not Applicable)

1.4 FUTURE WORK (Not Applicable)

1.5 WORK SEQUENCE

A. The Work will be conducted in a single phase.

1.6 CONTRACTOR USE OF PREMISES

A. General: During the construction period the Contractor shall have full use of the premises for construction operations, including use of the site. The Contractor's use of the premises limited only by the Owner's right to perform work or to retain other contractors on portions of the Project.

B. Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.

1. Owner Occupancy: Allow for Owner occupancy and use by the public.

2. Driveways and Entrances: Keep driveways and entrances serving the premises clear and available to the Owner, the Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

C. Use of the Existing Building: Maintain the existing building in a weathertight condition throughout the construction period. Repair damage cause by construction operations. Take all precautions necessary to protect the building and its occupants during the construction period..

1.7 OCCUPANCY REQUIREMENTS

A. Full Owner Occupancy: The Owner will occupy the site and existing building during the entire construction period. Cooperate with the Owner during construction operations to minimize conflicts and facilitate owner usage. Perform the Work so as not to interfere with the Owner's operations.

B. Partial Owner Occupancy: The Owner reserves the right to occupy and to place and install equipment in completed areas of the building prior to Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placing of equipment and partial occupancy shall not constitute acceptance of the total Work.

1. The Designer will prepare a Certificate of Partial Occupancy for each specific portion of the Work to be occupied prior to substantial completion.

2. Prior to partial Owner occupancy, mechanical and electrical systems shall be fully operational. Required inspections and tests shall have been successfully completed. Upon occupancy, the Owner will operate and maintain mechanical and electrical systems serving occupied portions for the building.

3. Upon occupancy, the Owner will assume responsibility for maintenance and custodial service for occupied portions for the building.

1.8 OWNER-FURNISHED PRODUCTS (Not Applicable)

1.9 MISCELLANEOUS PROVISIONS (Not Applicable)

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 SCHEDULE OF PRODUCTS ORDERED IN ADVANCE (Not Applicable)

END OF SECTION 011000

SECTION 012100 – ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements governing allowances.

1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order.

B. Types of allowances include the following:

1. Lump-sum allowances.
2. Weather allowances.

C. Related Sections include the following:

1. Division 1 Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders for allowances.
2. Division 1 Section "Unit Prices" for procedures for using unit prices.

1.3 WEATHER ALLOWANCE

A. Included within the completion period for this project are a specified number of “bad weather” days (see Schedule of Allowances).

B. The Contractor’s progress schedule shall clearly indicate the bad weather day allowance as an “activity” or “activities”. In the event weather conditions preclude performance of critical work activities for 50% or more of the Contractor’s scheduled workday, that day shall be declared unavailable for work due to weather (a “bad weather” day) and charged against the above allowance. Critical work activities will be determined by review of the Contractor’s current progress schedule.

C. The Contractor’s Representative and the Construction Representative shall agree monthly on the number of “bad weather” days to be charged against the allowance. This determination will be documented in writing and be signed by the Contractor and the Construction Representatives. If there is a failure to agree on all or part of the “bad weather” days for a particular month, that disagreement shall be noted on this written document and signed by each party’s representative. Failure of the Contractor’s representative to sign the “bad weather” day documentation after it is presented, with or without the notes of disagreement, shall constitute agreement with the “bad weather” day determination contained in that document.

D. There will be no modification to the time of contract performance due solely to the failure to deplete the “bad weather” day allowance.

E. Once this allowance is depleted, a no cost Change Order time extension will be executed for “bad weather” days, as defined above, encountered during the remainder of the Project.

1.4 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, Designer of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

B. At Designer's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Designer from the designated supplier.

1.5 SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

B. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.6 COORDINATION

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.7 ALLOWANCES

A. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials under allowance shall be included as part of the Contract Sum and not part of the allowance.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

A. Weather Allowance: Included within the completion period for this Project are two “bad weather” days.

END OF SECTION 012100

SECTION 012600 – CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for handling and processing Contract Modifications.

B. Related Sections include the following:

1. Division 1, Section 012100 "Allowances" for procedural requirements for handling and processing Allowances.
2. Division 1, Section 012200 "Unit Prices" for administrative requirements for using Unit Prices.
3. Division 1, Section 013115 “Project Management Communications” for administrative requirements for communications.
4. Division 0, Section 007213, Article 3.1 "Acceptable Substitutions" for administrative procedures for handling Requests for Substitutions made after Contract award.
5. Division 0, Section 007213, Article 4.0 "Changes in the Work" for Change Order requirements.

1.3 REQUESTS FOR INFORMATION

A. In the event that the Contractor or Subcontractor, at any tier, determines that some portion of the Drawings, Specifications, or other Contract Documents requires clarification or interpretation, the Contractor shall submit a “Request for Information” (RFI) in writing to the Designer. A RFI may only be submitted by the Contractor and shall only be submitted on the RFI forms provided by the Owner. The Contractor shall clearly and concisely set forth the issue for which clarification or interpretation is sought and why a response is needed. In the RFI, the Contractor shall set forth an interpretation or understanding of the requirement along with reasons why such an understanding was reached.

B. Responses to RFI shall be issued within ten (10) working days of receipt of the Request from the Contractor unless the Designer determines that a longer time is necessary to provide an adequate response. If a longer time is determined necessary by the Designer, the Designer will, within five (5) working days of receipt of the request, notify the Contractor of the anticipated response time. If the Contactor submits a RFI on a time sensitive activity on the current project schedule, the Contractor shall not be entitled to any time extension due to the time it takes the Designer to respond to the request provided that the Designer responds within the ten (10) working days set forth above.

C. Responses from the Designer will not change any requirement of the Contract Documents. In the event the Contractor believes that a response to a RFI will cause a change to the requirements of the Contract Document, the Contractor shall give written

notice to the Designer requesting a Change Order for the work. Failure to give such written notice within ten (10) working days, shall waive the Contractor's right to seek additional time or cost under Article 4, "Changes in the Work" of the General Conditions.

1.4 MINOR CHANGES IN THE WORK

A. Designer will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Amount or the Contract Time, on "Designer's Supplemental Instructions" (DSI).

1.5 PROPOSAL REQUESTS

A. The Designer or Owner Representative will issue a detailed description of proposed Changes in the Work that may require adjustment to the Contract Amount or the Contract Time. The proposed Change Description will be issued using the "Request for Proposal" (RFP) form. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Proposal Requests issued by the Designer or Owner Representative are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.

2. Within ten (10) working days after receipt of Proposal Request, submit a proposal for the cost adjustments to the Contract Amount and the Contract Time necessary to execute the Change. The Contractor shall submit his proposal on the appropriate Change Order Detailed Breakdown form. Subcontractors may use the appropriate Change Order Detailed Breakdown form or submit their proposal on their letterhead provided the same level of detail is included. All proposals shall include:

   a. A detailed breakdown of costs per Article 4.1 of the General Conditions.

   b. If requesting additional time per Article 4.2 of the General Conditions, include an updated Contractor's Construction Schedule that indicates the effect of the Change including, but not limited to, changes in activity duration, start and finish times, and activity relationship.

1.6 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Proposal Request, the Designer or Owner Representative will issue a Change Order for signatures of Owner and Contractor on the "Change Order" form.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 013100 – COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1. Coordination Drawings.
2. Administrative and supervisory personnel.
3. Project meetings.

B. Each Contractor shall participate in coordination requirements. Certain areas of responsibility will be assigned to a specific Contractor.

C. Related Sections include the following:

1. Division 1, Section 013200 "Schedules" for preparing and submitting Contractor's Construction Schedule.
2. Articles 1.8.B and 1.8.C of Section 007213 "General Conditions" for coordinating meetings onsite.
3. Article 5.4.H of Section 007213 "General Conditions" for coordinating Closeout of the Contract.

1.3 COORDINATION

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

B. Coordination: Each Contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each Contractor shall coordinate its operations with operations included in different Sections that depend on each other for proper installation, connection, and operation.

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

maintenance, service, and repair of all components including mechanical and electrical.

C. 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 Owner and separate Contractors if coordination of their Work is required.

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

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

E. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

1.4 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.

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

1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.5 PROJECT MEETINGS

A. The Owner’s Construction Representative will schedule a Pre-Construction Meeting prior to beginning of construction. The date, time, and exact place of this meeting will be determined after Contract Award and notification of all interested parties. The

Contractor shall arrange to have the Job Superintendent and all prime Subcontractors present at the meeting. During the Pre-Construction Meeting, the construction procedures and information necessary for submitting payment requests will be discussed and materials distributed along with any other pertinent information.

1. Minutes: Designer will record and distribute meeting minutes.

B. Progress Meetings: The Owner's Construction Representative will conduct Monthly Progress Meetings as stated in Articles 1.8.B and 1.8.C of Section 007213 "General Conditions".

1. Minutes: Designer will record and distribute to Contractor the meeting minutes.

C. Preinstallation Conferences: Contractor shall conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of Manufacturers and Fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Designer and Construction Representative of scheduled meeting dates.

2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration including requirements for the following:

   a. Contract Documents

   b. Options

   c. Related RFIs

   d. Related Change Orders

   e. Purchases

   f. Deliveries

   g. Submittals

   h. Review of mockups

   i. Possible conflicts

   j. Compatibility problems

   k. Time schedules

   l. Weather limitations

   m. Manufacturer's written recommendations

   n. Warranty requirements

   o. Compatibility of materials

   p. Acceptability of substrates

   q. Temporary facilities and controls

   r. Space and access limitations

   s. Regulations of authorities having jurisdiction

   t. Testing and inspecting requirements

u. Installation procedures

v. Coordination with other Work

w. Required performance results

x. Protection of adjacent Work

y. Protection of construction and personnel

3. Contractor shall record significant conference discussions, agreements, and disagreements including required corrective measures and actions.

4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.

5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

6. Revise paragraph below if Project requires holding progress meetings at different intervals. Insert special intervals such as "every third Tuesday" to suit special circumstances.

7. Project name

8. Name and address of Contractor

9. Name and address of Designer

10. RFI number including RFIs that were dropped and not submitted

11. RFI description

12. Date the RFI was submitted

13. Date Designer's response was received

14. Identification of related DSI or Proposal Request, as appropriate

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013115 - PROJECT MANAGEMENT COMMUNICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Division 1, Section 013300 - Submittals

C. Division 1, Section 012600 – Contract Modification Procedures

1.2 SUMMARY

A. Project Management Communications: The Contractor shall use the Internet web based project management communications tool, E-Builder® ASP software, and protocols included in that software during this project. The use of project management communications as herein described does not replace or change any contractual responsibilities of the participants.
   1. Project management communications is available through E-Builder® as provided by "e-Builder®" in the form and manner required by the Owner.
   2. The project communications database is on-line and fully functional. User registration, electronic and computer equipment, and Internet connections are the responsibility of each project participant. The sharing of user accounts is prohibited

B. Support: E-Builder® will provide on-going support through on-line help files.

C. Copyrights and Ownership: Nothing in this specification or the subsequent communications supersedes the parties' obligations and rights for copyright or document ownership as established by the Contract Documents. The use of CAD files, processes or design information distributed in this system is intended only for the project specified herein.

D. Purpose: The intent of using E-Builder® is to improve project work efforts by promoting timely initial communications and responses. Secondly, to reduce the number of paper documents while providing improved record keeping by creation of electronic document files

E. Authorized Users: Access to the web site will be by individuals who are authorized users.
   1. Individuals shall complete the E-Builder New Company/User Request Form located at the following web site: https://oa.mo.gov/facilities/vendor-links/contractor-forms.

Completed forms shall be emailed to the following email address: OA.FMDCE-BuilderSupport@oa.mo.gov.

2. Authorized users will be contacted directly and assigned a temporary user password.
3. Individuals shall be responsible for the proper use of their passwords and access to data as agents of the company in which they are employed.

F. Administrative Users: Administrative users have access and control of user licenses and all posted items. DO NOT POST PRIVATE OR YOUR COMPANY CONFIDENTIAL ITEMS IN THE DATABASE! Improper or abusive language toward any party or repeated posting of items intended to deceive or disrupt the work of the project will not be tolerated and will result in deletion of the offensive items and revocation of user license at the sole discretion of the Administrative User(s).

G. Communications: The use of fax, email and courier communication for this project is discouraged in favor of using E-Builder® to send messages. Communication functions are as follows:
1. Document Integrity and Revisions:
   a. Documents, comments, drawings and other records posted to the system shall remain for the project record. The authorship time and date shall be recorded for each document submitted to the system. Submitting a new document or record with a unique ID, authorship, and time stamp shall be the method used to make modifications or corrections.
   b. The system shall make it easy to identify revised or superseded documents and their predecessors.
   c. Server or Client side software enhancements during the life of the project shall not alter or restrict the content of data published by the system. System upgrades shall not affect access to older documents or software.
2. Document Security:
   a. The system shall provide a method for communication of documents. Documents shall allow security group assignment to respect the contractual parties communication except for Administrative Users. DO NOT POST PRIVATE OR YOUR COMPANY CONFIDENTIAL ITEMS IN THE DATABASE!
3. Document Integration:
   a. Documents of various types shall be logically related to one another and discoverable. For example, requests for information, daily field reports, supplemental sketches and photographs shall be capable of reference as related records.
4. Reporting:
   a. The system shall be capable of generating reports for work in progress, and logs for each document type. Summary reports generated by the system shall be available for team members.
5. Notifications and Distribution:
   a. Document distribution to project members shall be accomplished both within the extranet system and via email as appropriate. Project document distribution to parties outside of the project communication system shall be

accomplished by secure email of outgoing documents and attachments, readable by a standard email client.

6. Required Document Types:
    a. RFI, Request for Information.
    b. Submittals, including record numbering by drawing and specification section.
    c. Transmittals, including record of documents and materials delivered in hard copy.
    d. Meeting Minutes.
    e. Application for Payments (Draft or Pencil).
    f. Review Comments.
    g. Field Reports.
    h. Construction Photographs.
    i. Drawings.
    j. Supplemental Sketches.
    k. Schedules.
    l. Specifications.
    m. Request for Proposals
    n. Designer's Supplemental Instructions
    o. Punch Lists

H. Record Keeping: Except for paper documents, which require original signatures and large format documents (greater than 8½ x 11 inches), all other 8½ x 11 inches documents shall be submitted by transmission in electronic form to the E-Builder® web site by licensed users.
    a. The Owner and his representatives, the Designer and his consultants, and the Contractor and his Sub Contractors and suppliers at every tier shall respond to documents received in electronic form on the web site, and consider them as if received in paper document form.
    b. The Owner and his representatives, the Designer and his consultants, and the Contractor and his Sub Contractors and suppliers at every tier reserves the right to and shall reply or respond by transmissions in electronic form on the web site to documents actually received in paper document form.
    c. The Owner and his representatives, the Designer and his consultants, and the Contractor and his Sub Contractors and suppliers at every tier reserves the right to and shall copy any paper document into electronic form and make same available on the web site.

I. Minimum Equipment and Internet Connection: In addition to other requirements specified in this Section, the Owner and his representatives, the Construction Manager and his representatives, the Architect and his consultants, and the Contractor and his sub-contractors and suppliers at every tier required to have a user license(s) shall be responsible for the following:

1. Providing suitable computer systems for each licensed user at the users normal work location[1] with high-speed Internet access, i.e. DSL, local cable company's Internet connection, or T1 connection.
2. Each of the above referenced computer systems shall have the following minimum system[2] and software requirements:
    a. Desktop configuration (Laptop configurations are similar and should be equal to or exceed desktop system.)
        1) Operating System: Windows XP or newer
        2) Internet Browser: Internet Explorer 6.01SP2+ (Recommend IE7.0+)
        3) Minimum Recommend Connection Speed: 256K or above
        4) Processor Speed: 1 Gigahertz and above
        5) RAM: 512 mb
        6) Operating system and software shall be properly licensed.
        7) Internet Explorer version 7 (current version is a free distribution for download). This specification is not intended to restrict the host server or client computers provided that industry standard HTTP clients may access the published content.
        8) Adobe Acrobat Reader (current version is a free distribution for download).
        9) Users should have the standard Microsoft Office Suite (current version must be purchased) or the equivalent.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable.)

END OF SECTION 013115

[1] The normal work location is the place where the user is assigned for more than one-half of his time working on this project.
[2] The minimum system herein will not be sufficient for many tasks and may not be able to process all documents and files stored in the E-Builder® Documents area.

SECTION 013200 – SCHEDULE – BAR CHART

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes requirements for a Bar Chart Schedule for the project construction activities, schedule of submittals, and schedule for testing.

PART 2 - PRODUCTS – (Not Applicable)

PART 3 - EXECUTION

3.1 SUBMITTAL PROCEDURES

A. The Contractor shall submit to the Designer, within ten (10) working days following the Notice to Proceed, a Progress Schedule including Schedule of Values showing the rate of progress the Contractor agrees to maintain and the order in which he proposed to carry out the various phases of Work. No payments shall be made to the Contractor until the Progress Schedule has been approved by the Owner.

1. The Schedule of Values must have the following line items included with the value of the item as indicated below:

   a. O&M's (Owner's Manual)

      1) $1,000,000.00 (One million) and under – 2% of the total contract amount

      2) Over $1,000,000.00 (One million) – 1% of the total contract amount

   b. Close Out Documents

      1) $1,000,000.00 (One million) and under – 2% of the total contract amount

      2) Over $1,000,000.00 (One million) – 1% of the total contract amount

   c. General Conditions

      1) No more than 10%

B. The Contractor shall submit an updated Schedule for presentation at each Monthly Progress Meeting. The Schedule shall be updated by the Contractor as necessary to reflect the current Schedule and its relationship to the original Schedule. The updated Schedule shall reflect any changes in the logic, sequence, durations, or completion date. Payments to the Contractor shall be suspended if the Progress Schedule is not adequately updated to reflect actual conditions.

C. The Contractor shall submit Progress Schedules to Subcontractors to permit coordinating their Progress Schedules to the general construction Work. The Contractor shall coordinate preparation and processing of Schedules and reports with performance of other construction activities.

3.2 CONSTRUCTION PROGRESS SCHEDULE – BAR CHART SCHEDULE

A. Bar-Chart Schedule: The Contractor shall prepare a comprehensive, fully developed, horizontal bar chart-type Contractor's Construction Schedule. The Contractor for general construction shall prepare the Construction Schedule for the entire Project. The Schedule shall show the percentage of work to be completed at any time, anticipated monthly payments by Owner, as well as significant dates (such as completion of excavation, concrete foundation work, underground lines, superstructure, rough-ins, enclosure, hanging of fixtures, etc.) which shall serve as check points to determine compliance with the approved Schedule. The Schedule shall also include an activity for the number of "bad" weather days specified in Section 012100 – Allowances.

1. The Contractor shall provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week.

    a. If practical, use the same Schedule of Values breakdown for schedule time bars.

2. The Contractor shall provide a base activity time bar showing duration for each construction activity. Each bar is to indicate start and completion dates for the activity. The Contractor is to place a contrasting bar below each original schedule activity time for indicating actual progress and planned remaining duration for the activity.

3. The Contractor shall prepare the Schedule on a minimal number of separate sheets to readily show the data for the entire construction period.

4. Secure time commitments for performing critical elements of the Work from parties involved. Coordinate each element on schedule with other construction activities. Include minor elements involved in the overall sequence of the Work. Show each activity in proper sequence. Indicate graphically the sequences necessary for completion of related portions of the Work.

5. Coordinate the Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittal Schedule, progress reports, payment requests, and other required schedules and reports.

6. Indicate the Intent to Award and the Contract Substantial Completion dates on the schedule.

B. Phasing: Provide notations on the schedule to show how the sequence of the Work is affected by the following:

1. Requirement for Phased completion

2. Work by separate Contractors

3. Work by the Owner

4. Pre-purchased materials

5. Coordination with existing construction

6. Limitations of continued occupancies

7. Un-interruptible services
8. Partial Occupancy prior to Substantial Completion
9. Site restrictions
10. Provisions for future construction
11. Seasonal variations
12. Environmental control

C. Work Stages: Use crosshatched bars to indicate important stages of construction for each major portion of the Work. Such stages include, but are not necessarily limited to, the following:

1. Subcontract awards
2. Submittals
3. Purchases
4. Mockups
5. Fabrication
6. Sample testing
7. Deliveries
8. Installation
9. Testing
10. Adjusting
11. Curing
12. Startup and placement into final use and operation

D. Area Separations: Provide a separate time bar to identify each major area of construction for each major portion of the Work. For the purposes of this Article, a "major area" is a story of construction, a separate building, or a similar significant construction element.

1. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
    a. Structural completion.
    b. Permanent space enclosure
    c. Completion of mechanical installation
    d. Completion of the electrical portion of the Work
    e. Substantial Completion

3.3 SCHEDULE OF SUBMITTALS

A. Upon acceptance of the Construction Progress Schedule, prepare and submit a complete schedule of submittals. Coordinate the submittal schedule with Section 013300 SUBMITTALS, the approved Construction Progress Schedule, list of subcontracts, Schedule of Values and the list of products.

B. Prepare the schedule in chronological order. Provide the following information

1. Scheduled date for the first submittal
2. Related Section number
3. Submittal category
4. Name of the Subcontractor
5. Description of the part of the Work covered
6. Scheduled date for resubmittal
7. Scheduled date for the Designer's final release or approval

C. Distribution: Following the Designer's response to the initial submittal schedule, print and distribute copies to the Designer, Owner, subcontractors, and other parties required to comply with submittal dates indicated.

1. Post copies in the Project meeting room and temporary field office.
2. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned part of the Work and are no longer involved in construction activities.

D. Schedule Updating: Revise the schedule after each meeting or other activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

3.4 SCHEDULE OF INSPECTIONS AND TESTS

A. Prepare a schedule of inspections, tests, and similar services required by the Contract Documents. Submit the schedule with (15) days of the date established for commencement of the Contract Work. The Contractor is to notify the testing agency at least (5) working days in advance of the required tests unless otherwise specified.

B. Form: This schedule shall be in tabular form and shall include, but not be limited to, the following:

1. Specification Section number
2. Description of the test
3. Identification of applicable standards
4. Identification of test methods
5. Number of tests required
6. Time schedule or time span for tests
7. Entity responsible for performing tests
8. Requirements for taking samples
9. Unique characteristics of each service

C. Distribution: Distribute the schedule to the Owner, Architect, and each party involved in performance of portions of the Work where inspections and tests are required.

END OF SECTION 013200

SECTION 013300 – SUBMITTALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Division 1, Section 013115 “Project Management Communications” for administrative requirements for communications.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for submittals required for performance of the Work including the following:

1. Shop Drawings
2. Product Data
3. Samples
4. Quality Assurance Submittals
5. Construction Photographs
6. Operating and Maintenance Manuals
7. Warranties

B. Administrative Submittals: Refer to General and Supplementary Conditions other applicable Division 1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to, the following:

1. Construction Progress Schedule including Schedule of Values
2. Performance and Payment Bonds
3. Insurance Certificates
4. Applications for Payment
5. Certified Payroll Reports
6. Partial and Final Receipt of Payment and Release Forms
7. Affidavit – Compliance with Prevailing Wage Law
8. Record Drawings
9. Notifications, Permits, etc.

C. The Contractor is obliged and responsible to check all shop drawings and schedules to assure compliance with contract plans and specifications. The Contractor is responsible for the content of the shop drawings and coordination with other contract work. Shop drawings and schedules shall indicate, in detail, all parts of an Item or Work including erection and setting instructions and integration with the Work of other trades.

D. The Contractor shall at all times make a copy, of all approved submittals, available on site to the Construction Representative.

1.3 SUBMITTAL PROCEDURES

A. The Contractor shall comply with the General and Supplementary Conditions and other applicable sections of the Contract Documents. The Contractor shall submit, with such promptness as to cause no delay in his work or in that of any other contractors, all required submittals indicated in Part 3.1 of this section and elsewhere in the Contract Documents. Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
    a. The Designer reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.

B. Each drawing and/or series of drawings submitted must be accompanied by a letter of transmittal giving a list of the titles and numbers of the drawings. Each series shall be numbered consecutively for ready reference and each drawing shall be marked with the following information:

1. Date of Submission
2. Name of Project
3. Location
4. Section Number of Specification
5. State Project Number
6. Name of Submitting Contractor
7. Name of Subcontractor
8. Indicate if Item is submitted as specified or as a substitution

1.4 SHOP DRAWINGS

A. Comply with the General Conditions, Article 3.2.

B. The Contractor shall submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing.

C. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates, and similar drawings including the following information:

1. Dimensions
2. Identification of products and materials included by sheet and detail number
3. Compliance with specified standards
4. Notation of coordination requirements

5. Notation of dimensions established by field measurement

6. Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8½"x11" but no larger than 36"x48".

1.5 PRODUCT DATA

A. The Contractor shall comply with the General Conditions, Article 3.2.

B. The Contractor shall collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.

1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required, mark copies to indicate the applicable information including the following information:

a. Manufacturer's printed recommendations

b. Compliance with Trade Association standards

c. Compliance with recognized Testing Agency standards

d. Application of Testing Agency labels and seals

e. Notation of dimensions verified by field measurement

f. Notation of coordination requirements

2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.

1.6 SAMPLES (Not Applicable)

1.7 QUALITY ASSURANCE DOCUMENTS

A. The Contractor shall comply with the General Conditions, Article 3.2

B. The Contractor shall submit quality control submittals including design data, certifications, manufacturer's instructions, manufacturer's field reports, and other quality-control submittals as required under other Sections of the Specifications.

C. Certifications: Where other Sections of the Specifications require certification that a product, material, or installation complies with specified requirements, submit a notarized certification from the Manufacturer certifying compliance with specified requirements.

1. Signature: Certification shall be signed by an officer of the Manufacturer or other individual authorized to contractually bind the Company.

D. Inspection and Test Reports: The Contractor shall submit the required inspection and test reports from independent testing agencies as specified in this Section and in other Sections of the Contract Documents.

E. Construction Photographs: The Contractor shall submit record construction photographs as specified in this Section and in other Sections of the Contract Documents.

1. The Contractor shall submit digital photographs. The Construction Administrator shall determine the quantity and naming convention at the preconstruction meeting.

2. The Contractor shall identify each photograph with project name, location, number, date, time, and orientation.

3. The Contractor shall submit progress photographs monthly unless specified otherwise. Photographs shall be taken one (1) week prior to submitting.

4. The Contractor shall take four (4) site photographs from differing directions and a minimum of five (5) interior photographs indicating the relative progress of the Work.

1.8 OPERATING AND MAINTENANCE MANUALS AND WARRANTIES

A. The Contractor shall submit all required manufacturer's operating instructions, maintenance/service manuals, and warranties in accordance with the General Conditions, Article 3.5, and Supplementary Conditions along with this and other Sections of the Contract Documents.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 REQUIRED SUBMITTALS

A. Contractor shall submit the following information for materials and equipment to be provided under this contract.

SPEC SECTION	TITLE	CATEGORY
013200	Schedules	Construction Schedule
013200	Schedules	Schedule of Values
013200	Schedules	List of Subcontractors
013200	Schedules	Major Material Suppliers
017900	Demonstration and Training	Operation / Maintenance Manual
200548	Seismic Controls for MEPFTR Systems	Test Report
200548	Seismic Controls for MEPFTR Systems	Product Data
200548	Seismic Controls for MEPFTR Systems	Shop Drawings
200548	Seismic Controls for MEPFTR Systems	Certification
260500	Common Work Results for Electrical	Product Data
260502	Equipment Wiring Systems	Product Data
260502	Equipment Wiring Systems	Shop Drawings
260519	Low-Voltage Elec Power Cond and Cables	Product Data
260519	Low-Voltage Elec Power Cond and Cables	Test Report
260519	Low-Voltage Elec Power Cond and Cables	As-Builts
260519	Low-Voltage Elec Power Cond and Cables	Operation / Maintenance Manual
260526	Grounding and Bonding for Electrical Systems	Product Data
260526	Grounding and Bonding for Electrical Systems	Test Report
260526	Grounding and Bonding for Electrical Systems	As-Builts
260526	Grounding and Bonding for Electrical Systems	Shop Drawings

260529	Hangers and Supports for Electrical Systems	Product Data
260533	Raceway and Boxes for Electrical Systems	Product Data
260533	Raceway and Boxes for Electrical Systems	As-Builts
260548	Seismic Controls for Electrical Systems	Product Data
260553	Identification for Electrical Systems	Product Data
260553	Identification for Electrical Systems	Sample
260573	Power System Studies	Product Data
260573	Power System Studies	As-Builts
260573	Power System Studies	Sample
260573	Power System Studies	Certification
260573	Power System Studies	Operation / Maintenance Manual
262200	Low-Voltage Transformers	Product Data
262200	Low-Voltage Transformers	Shop Drawings
262200	Low-Voltage Transformers	Test Report
262200	Low-Voltage Transformers	Operation / Maintenance Manual
262200	Low-Voltage Transformers	Warranty
262413	Switchboards	Product Data
262413	Switchboards	Shop Drawings
262413	Switchboards	Certification
262413	Switchboards	As-Builts
262413	Switchboards	Operation / Maintenance Manual
262413	Switchboards	Test Report
262413	Switchboards	Warranty
262416	Panelboards	Product Data
262416	Panelboards	Shop Drawings
262416	Panelboards	Test Report
262416	Panelboards	Operation / Maintenance Manual
262416	Panelboards	Warranty
262726	Wiring Devices	Product Data
262813	Fuses	Product Data
262813	Fuses	Operation / Maintenance Manual
262813	Fuses	Extra Materials
262816	Enclosed Switches and Circuit Breakers	Product Data
262816	Enclosed Switches and Circuit Breakers	Shop Drawings
262816	Enclosed Switches and Circuit Breakers	Test Report
262816	Enclosed Switches and Circuit Breakers	Operation / Maintenance Manual
262816	Enclosed Switches and Circuit Breakers	Warranty
262816	Enclosed Switches and Circuit Breakers	Extra Materials
263213	Packaged Engine-Driven Generators	Product Data
263213	Packaged Engine-Driven Generators	Shop Drawings
263213	Packaged Engine-Driven Generators	Certification
263213	Packaged Engine-Driven Generators	Test Report
263213	Packaged Engine-Driven Generators	Operation / Maintenance Manual
263213	Packaged Engine-Driven Generators	Warranty

263213	Packaged Engine-Driven Generators	Extra Materials
263215	Generator Termination Cabinets	Product Data
263215	Generator Termination Cabinets	Shop Drawings
263215	Generator Termination Cabinets	Test Report
263215	Generator Termination Cabinets	Operation / Maintenance Manual
263215	Generator Termination Cabinets	Warranty
263600	Transfer Switches	Product Data
263600	Transfer Switches	Shop Drawings
263600	Transfer Switches	Test Report
263600	Transfer Switches	Warranty
263600	Transfer Switches	Operation / Maintenance Manual
263600	Transfer Switches	Extra Materials
264313	Surge Protective Devices	Product Data
264313	Surge Protective Devices	Shop Drawings
264313	Surge Protective Devices	Test Report
264313	Surge Protective Devices	Warranty
264313	Surge Protective Devices	Operation / Maintenance Manual
264313	Surge Protective Devices	As-Builts
264313	Surge Protective Devices	Extra Materials
265100	Interior Lighting	Product Data
265100	Interior Lighting	Shop Drawings
265100	Interior Lighting	Test Report
265100	Interior Lighting	Operation / Maintenance Manual
265100	Interior Lighting	Warranty
265100	Interior Lighting	Extra Materials

END OF SECTION 013300

SECTION 013513.16 - SITE SECURITY AND HEALTH REQUIREMENTS (DOC)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUBMITTALS

A. List of required submittals:

1. Materials Safety Data Sheets for all hazardous materials to be brought onsite.
2. Schedule of proposed shutdowns, if applicable.
3. Revise list to include all required submittals.
4. A list of the names of all employees who will submit fingerprints for a background check, and the signed privacy documents identified below for each employee.
5. Tuberculin skin test results for all employees required to be tested as set forth below.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 ACCESS TO THE SITE

A. The Contractor shall arrange with Facility Representatives to establish procedures for the controlled entry of workers and materials into the work areas at the Facility.

B. The Contractor shall establish regular working hours with Facility Representatives. The Contractor must report changes in working hours or overtime to Facility Representatives and obtain approval twenty-four (24) hours ahead of time. The Contractor shall report emergency overtime to Facility Representatives as soon as it is evident that overtime is needed. The Contractor must obtain approval from Facility Representatives for all work performed after dark.

C. The Contractor shall provide the name and phone number of the Contractor's employee or agent who is in charge onsite; this individual must be able to be contacted in case of emergency. The Contractor must be able to furnish names and address of all employees upon request.

D. The Contractor shall provide Facility Representatives notice twenty-four (24) hours prior to any possible vehicle entry and/or required escort. The Contractor shall maintain a time log of any delays in gaining entrance to the Facility due to lack of an escort, which is to be submitted monthly with the Contractor's pay request materials. The purpose of this log is to establish a basis for a contract change, if required. The log shall contain the date and time of delay, date and time of request of entry, workers delayed (name and occupation), and name of the Facility Representative to whom the request was made, if possible. Any delay in entry must be

validated by sallyport and pass office personnel at the Facility. Only delays greater than thirty (30) minutes will be considered for a contract change. A 30-minute delay upon arrival with a vehicle to enter the sallyport should be expected.

3.2 RULES OF THE FACILITY

A. The Contractor and its workers shall observe the following rules:

1. There shall be no fraternization with inmates.
2. No intoxicating beverages or illegal drugs shall be brought onto Facility grounds.
3. No firearms, other weapons, or explosives shall be carried onto Facility grounds.
4. No prescription drugs above one day's dosage shall be carried on Facility grounds.
5. Any vehicle or individual is subject to search at any time while on Facility grounds.
6. The vehicles of the Contractor and its workers shall be locked whenever unattended.
7. All tools and equipment shall be tightly secured during non-working hours in the Contractor's storage trailer or assigned area.
8. The Facility will not be responsible for the Contractor's tools, equipment, or materials. The Contractor shall keep and maintain a current tool inventory. The tool inventory shall be made available to Facility Representatives and the Owner upon request.
9. The Contractor shall report any missing tools to Facility Representatives immediately.
10. Smoking shall be permitted only in accordance with the regulations of the Facility.
11. Possession or use of smokeless tobacco or smokeless non-tobacco alternatives is strictly prohibited.

B. All workers shall be required to sign an acknowledgement of receipt of these rules.

3.3 SECURITY CLEARANCES AND RESTRICTIONS

A. DOC SECURITY CLEARANCE REQUIREMENTS

1. Prior to the commencement of any onsite work, the Contractor shall submit a list containing the name, date of birth, and Missouri driver's license number or social security number of all construction personnel to the Missouri Department of Corrections for the purpose of obtaining security clearances. The required information shall be submitted at the pre-construction meeting, or as otherwise directed by Department of Corrections' personnel. Any construction personnel with pending warrants or felony convictions within the last five (5) years or other offenses deemed to create a security risk by Department of Corrections shall not be allowed onsite. The Department of Corrections reserves the right to refuse admission to any individual they feel may be detrimental to the security of the Facility.

3.4 FIRE PROTECTION, SAFETY, AND HEALTH CONTROLS

A. The Contractor shall take all necessary precautions to guard against and eliminate possible fire hazards.

1. Onsite burning is prohibited.
2. The Contractor shall store all flammable or hazardous materials in proper containers

located outside the buildings or offsite, if possible.

3. The Contractor shall provide and maintain, in good order, during construction fire extinguishers as required by the National Fire Protection Association. In areas of flammable liquids, asphalt, or electrical hazards, 15-pound carbon dioxide or 20-pound dry chemical extinguishers shall be provided.

B. The Contractor shall not obstruct streets or walks without permission from the Owner's Construction Representative and Facility Representatives.

C. The Contractor's personnel shall not exceed the speed limit of 15 mph while at the Facility unless otherwise posted.

D. The Contractor shall take all necessary, reasonable measures to reduce air and water pollution by any material or equipment used during construction. The Contractor shall keep volatile wastes in covered containers, and shall not dispose of volatile wastes or oils in storm or sanitary drains.

E. The Contractor shall keep the project site neat, orderly, and in a safe condition at all times. The Contractor shall immediately remove all hazardous waste, and shall not allow rubbish to accumulate. The Contractor shall provide onsite containers for collection of rubbish and shall dispose of it at frequent intervals during the progress of the Work.

F. Fire exits, alarm systems, and sprinkler systems shall remain fully operational at all times, unless written approval is received from the Owner's Construction Representative and the appropriate Facility Representative at least twenty-four (24) hours in advance. The Contractor shall submit a written time schedule for any proposed shutdowns.

G. For all hazardous materials brought onsite, Material Safety Data Sheets shall be on site and readily available upon request at least a day before delivery.

H. The Contractor's workers shall not be under the influence of any intoxicating substances while on the Facility premises.

3.5 TUBERCULOSIS TESTING REQUIREMENTS

A. All workers who will be in the confines of the Facility for more than ten (10) consecutive working days must provide proof of a negative tuberculin skin test. The test results must be no more than six (6) months old at the commencement of construction. The Contractor or the worker, not the Owner, shall pay the cost of the test.

B. The Contractor shall submit to Facility Representatives current tuberculin skin test results for all workers who are required to have such a test in accordance with paragraph A above. If the contract period extends for more than twelve (12) months, the Contractor must provide new test results for all workers prior to the anniversary of the contract commencement date.

C. Any worker required to have a tuberculin skin test under paragraph A above who fails or refuses to do so will be denied admission to the facility until such time as proof of the test results are provided.

D. If any worker has a tuberculin skin test with positive results, the worker shall be denied access

to the facility until the worker produces a certification from a physician licensed to practice in the State of Missouri that the worker does not have infectious tuberculosis.

E. The Contractor shall not be entitled to any additional time or compensation if any of its workers are denied access to the facility because of failure to produce negative tuberculin skin test results.

F. Failure or refusal of the Contractor to maintain and produce the required tuberculin skin test records shall be a material breach of this contract, which shall subject the Contractor to a declaration of default.

3.6 PREA FOR CONTRACTORS AND EMPLOYEES

A. The contractor and all of the contractor's employees and agents providing services in any Department of Corrections institution must be at least 18 years of age. A Missouri Uniform Law Enforcement System (MULES) check or other background investigation may be required on the contractor, the contractor's employees and agents before they are allowed entry into the institution. The contractor, its employees and agents understand and agree that the Department may complete criminal background records checks annually for the contractor and the contractor's employees and agents that have the potential to have contact with inmates.

B. The institution shall have the right to deny access into the institution for the contractor and any of the contractor's employees and agents for any reason, at the discretion of the institution.

C. The contractor, its employees and agents under active federal or state felony or misdemeanor supervision must receive written division director approval prior to providing services pursuant to a Department contract. Similarly, contractors/employees/agents with prior felony convictions and not under active supervision must receive written division director approval in advance.

D. The contractor, its employees and agents shall at all times observe and comply with all applicable state statutes, Department rules, regulations, guidelines, internal management policies and procedures, and general orders of the Department that are applicable, regarding operations and activities in and about all Department property. Furthermore, the contractor, its employees and agents, shall not obstruct the Department or any of its designated officials from performing their duties in response to court orders or in the maintenance of a secure and safe correctional environment. The contractor shall comply with the Department's policies and procedures relating to employee conduct.

1. The Department has a zero tolerance policy for any form of sexual misconduct to include staff/contractor/volunteer on offender, or offender on offender, sexual harassment, sexual assault, sexual abuse and consensual sex.

    a. Any contractor or contractor's employee or agent who witnesses any form of sexual misconduct must immediately report it to the warden of the institution. If a contractor or contractor's employee or agent fails to report or knowingly condones sexual harassment or sexual contact with or between offenders, the Department may cancel the contract, or at the Department's sole discretion, require the contractor to remove the employee/agent from providing services under the contract.
    b. Any contractor or contractor's employee or agent who engages in sexual abuse

shall be prohibited from entering the institution and shall be reported to law enforcement agencies and licensing bodies, as appropriate.

E. The contractor, its employees and agents shall not interact with the offenders except as is necessary to perform the requirements of the contract. The contractor, its employees and agents shall not give anything to nor accept anything from the offenders except in the normal performance of the contract.

F. If any contractor or contractor's employee or agent is denied access into the institution for any reason or is denied approval to provide service to the Department for any reason stated herein, it shall not relieve the contractor of any requirements of the contract. If the contractor is unable to perform the requirements of the contract for any reason, the contractor shall be considered in breach.

3.7 DISRUPTION OF UTILITIES

A. The Contractor shall give a minimum of seventy-two (72) hours written notice to the Construction Representative and the Facility Representative before disconnecting electric, gas, water, fire protection, or sewer service to any building.

B. The Contractor shall give a minimum of seventy-two (72) hours written notice to the Construction Representative and Facility Representative before closing any access drives, and shall make temporary access available, if possible. The Contractor shall not obstruct streets, walks, or parking

3.8 CELL PHONES AND ELECTRONIC DEVICES

A. Cell Phones, pagers, smart watches (that can send/receive messages), fitness wrist bands (that can send/receive messages) or other electronic devices are not permitted.

1. Contractors, repairpersons, or information technology services department staff may be permitted to bring in a cell phone and portable wireless router (Wi-Fi, MiFi, etc.) if approved by the Chief Administrative Officer (CAO) when the phone is necessary to complete job duties relating to repairs on a case by case basis.
2. Tables (IPad, etc.) are not allowed with the exception of for re-entry purposes approved via the division of adult institutions (DAI) director and the re-entry manager.
3. Laptop computers may be permitted by the CAO on a case by case basis.

3.9 PROTECTION OF PERSONS AND PROPERTY

A. SAFETY PRECAUTIONS AND PROGRAMS

1. The Contractor shall at all times conduct operations under this Contract in a manner to avoid the risk of bodily harm to persons or risk of damage to any property. The Contractor shall promptly take precautions which are necessary and adequate against conditions created during the progress of the Contractor's activities hereunder which involve a risk of bodily harm to persons or a risk of damage to property. The Contractor shall continuously inspect Work, materials, and equipment to discover and determine any

such conditions and shall be solely responsible for discovery, determination, and correction of any such conditions. The Contractor shall comply with applicable safety laws, standards, codes, and regulations in the jurisdiction where the Work is being performed, specifically, but without limiting the generality of the foregoing, with rules regulations, and standards adopted pursuant to the Williams-Steiger Occupational Safety and Health Act of 1970 and applicable amendments.

2. All contractors, subcontractors and workers on this project are subject to the Construction Safety Training provisions 292.675 RSMo.
3. In the event the Contractor encounters on the site, material reasonably believed to be asbestos, polychlorinated biphenyl (PCB), lead, mercury, or other material known to be hazardous, which has not been rendered harmless, the Contractor shall immediately stop Work in the area affected and report the condition to the Owner's Representative and the Architect in writing. The Work in the affected area shall not thereafter be resumed except by written agreement of the Owner's Representative and Contractor if in fact the material is asbestos or polychlorinated biphenyl (PCB) and has not been rendered harmless. The Work in the affected area shall be resumed in the absence of asbestos or polychlorinated biphenyl (PCB), or when it has been rendered harmless by written agreement of the Owner's Representative and the Contractor. “Rendered Harmless” shall mean that levels of such materials are less than any applicable exposure standards, including but limited to OSHA regulations.

B. SAFETY OF PERSONS AND PROPERTY

1. The Contractor shall take reasonable precautions for safety of, and shall provide protection to prevent damage, injury, or loss to:

    a. clients, staff, the public, construction personnel, and other persons who may be affected thereby;
    b. the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor or the Contractor's Subcontractors of any tier; and
    c. other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

2. The Contractor shall give notices and comply with applicable laws, standards, codes, ordinances, rules, regulations, and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury, or loss.
3. The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, safeguards for safety and protection, including, but not limited to, posting danger signs and other warnings against hazards, promulgating safety regulations, and notifying owners and users of adjacent sites and utilities.
4. When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise the highest degree of care and carry on such activities under supervision of properly qualified personnel.
5. The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in this Section caused in whole or in part by the Contractor, a Subcontractor of any tier, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable, and for which the Contractor is responsible under this

Section, except damage or loss attributable solely to acts or omissions of Owner or the Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's other obligations stated elsewhere in the Contract.

6. The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents, and the maintaining, enforcing and supervising of safety precautions and programs. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner's Representative and Architect. The Contractor shall hold regularly scheduled safety meetings to instruct Contractor personnel on safety practices, accident avoidance and prevention, and the Project Safety Program. The Contractor shall furnish safety equipment and enforce the use of such equipment by its employees and its subcontractors of any tier.
7. The Contractor shall not load or permit any part of the construction or site to be loaded so as to endanger its safety.
8. The Contractor shall promptly report in writing to the Owner all accidents arising out of or in connection with the Work which cause death, lost time injury, personal injury, or property damage, giving full details and statements of any witnesses. In addition, if death, serious personal injuries, or serious property damages are caused, the accident shall be reported immediately.
9. The Contractor shall promptly notify in writing to the Owner of any claims for injury or damage to personal property related to the work, either by or against the Contractor.
10. The Owner assumes no responsibility or liability for the physical condition or safety of the Work site or any improvements located on the Work site. The Contractor shall be solely responsible for providing a safe place for the performance of the Work. The Owner shall not be required to make any adjustment in either the Contract Sum or Contract Time concerning any failure by the Contractor or any Subcontractor to comply with the requirements of this Paragraph.
11. In no event shall the Owner have control over, charge of, or any responsibility for construction means, methods, techniques, sequences or procedures or for safety precautions and programs in connection with the Work, notwithstanding any of the rights and authority granted the Owner in the Contract Documents.
12. The Contractor shall maintain at his own cost and expense, adequate, safe and sufficient walkways, platforms, scaffolds, ladders, hoists and all necessary, proper, and adequate equipment, apparatus, and appliances useful in carrying on the Work and which are necessary to make the place of Work safe and free from avoidable danger for clients, staff, the public and construction personnel, and as may be required by safety provisions of applicable laws, ordinances, rules regulations and building and construction codes.

END OF SECTION 013513.16

SECTION 015000 – CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes requirements for construction facilities and temporary controls including temporary utilities, support facilities, security, and protection.

B. Temporary utilities include, but are not limited to, the following:

1. Water service and distribution
2. Temporary electric power and light
3. Temporary heat
4. Ventilation
5. Telephone service
6. Sanitary facilities, including drinking water
7. Storm and sanitary sewer

C. Support facilities include, but are not limited to, the following:

1. Field offices and storage sheds
2. Temporary roads and paving
3. Dewatering facilities and drains
4. Temporary enclosures
5. Hoists and temporary elevator use
6. Temporary project identification signs and bulletin boards
7. Waste disposal services
8. Rodent and pest control
9. Construction aids and miscellaneous services and facilities

D. Security and protection facilities include, but are not limited to, to following:

1. Temporary fire protection
2. Barricades, warning signs, and lights
3. Sidewalk bridge or enclosure fence for the site
4. Environmental protection

1.3 SUBMITTALS

A. Temporary Utilities: Submit reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.

B. Implementation and Termination Schedule: Within (15) days of the date established for commencement of the Work, submit a schedule indicating implementation and termination of each temporary utility.

1.4 QUALITY ASSURANCE

A. Regulations: Comply with industry standards and applicable laws and regulations including, but not limited to, the following:

1. Building code requirements
2. Health and safety regulations
3. Utility company regulations
4. Police, fire department, and rescue squad rules
5. Environmental protection regulations

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

1. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70 "National Electric Code".

C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.5 PROJECT CONDITIONS

A. Temporary Utilities: Prepare a schedule indicating dates for implementation and termination of each temporary utility. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary service to use of permanent service.

B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the Work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist onsite.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide new materials. If acceptable to the Designer, the Contractor may use undamaged, previously used materials in serviceable condition. Provide materials suitable for use intended.

B. Lumber and Plywood: Comply with requirements in Division 6 Section "Rough Carpentry".

1. For job-built temporary office, shops, and sheds within the construction area, provide UL-labeled, fire-treated lumber and plywood for framing, sheathing, and siding.

2. For signs and directory boards, provide exterior-type, Grade B-B high-density concrete form overlay plywood of sized and thicknesses indicated.

3. For fences and vision barriers, provide minimum 3/9" (9.5mm) thick exterior plywood.

4. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8" (16mm) thick exterior plywood.

C. Gypsum Wallboard: Provide gypsum wallboard on interior walls of temporary offices.

D. Roofing Materials: Provide UL Class A standard-weight asphalt shingles or UL Class C mineral-surfaced roll roofing on roofs of job-built temporary office, shops, and shed.

E. Paint: Comply with requirements of Division 9 Section "Painting".

1. For job-built temporary offices, shops, sheds, fences, and other exposed lumber and plywood, provide exterior-grade acrylic-latex emulsion over exterior primer.

2. For sign panels and applying graphics, provide exterior-grade alkyd gloss enamel over exterior primer.

3. For interior walls of temporary offices, provide two (2) quarts interior latex-flat wall paint.

F. Tarpaulins: Provide waterproof, fire-resistant, UL-labeled tarpaulins with flame-spread rating of (15) or less. For temporary enclosures, provide translucent, nylon-reinforced laminated polyethylene or polyvinyl chloride, fire-retardant tarpaulins.

G. Water: Provide potable water approved by local health authorities.

H. Open-Mesh Fencing: Provide 0.120" (3mm) thick, galvanized 2" (50mm) chainlink fabric fencing 6' (2m) high with galvanized steel pipe posts, 1½" (38mm) ID for line posts and 2½" (64mm) ID for corner posts.

2.2 EQUIPMENT

A. General: Provide new equipment. If acceptable to the Designer, the Contractor may use undamaged, previously used equipment in serviceable condition. Provide equipment suitable for use intended.

B. Water Hoses: Provide ¾" (19mm), heavy-duty, abrasion-resistant, flexible rubber hoses 100' (30m) long, with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shutoff nozzles at hose discharge.

C. Electrical Outlets: Provide properly configured, NEMA-polarized outlets to prevent insertion of 110 to 120V plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button, and pilot light for connection of power tools and equipment.

D. Electrical Power Cords: Provide grounded extension cords. Use hard-service cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage rating.

E. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered-glass enclosures where exposed to breakage. Provide exterior fixture where exposed to moisture.

F. Heating Units: Provide temporary heating units that have been tested and labeled by UL, FM, or another recognized trade association related to the type of fuel being consumed.

G. Temporary Offices: Provide prefabricated or mobile units or similar job-built construction with lockable entrances, operable windows, and serviceable finishes. Provide heated and air-conditioned units on foundations adequate for normal loading.

H. Temporary Toilet Units: Provide self-contained, single-occupant toilet units of the chemical, aerated re-circulation, or combustion type. Provide units properly vented and fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

I. Fire Extinguishers: Provide hand-carried, portable, UL-rated, Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand-carried, portable, UL-rated, Class ABC, dry-chemical extinguishers, or a combination of extinguishers of NFPA-recommended classes for the exposures.

1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.

B. Provide each Facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Engage the appropriate local utility company to install temporary service or connect to existing service. Where company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with company recommendations.

1. Arrange with company and existing users for a time when service can be interrupted, if necessary, to make connections for temporary services.

2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.

3. Obtain easements to bring temporary utilities to the site where the Owner’s easements cannot be used for that purpose.

4. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Designer. Neither the Owner nor Designer will accept cost or use charges as a basis of claims for Change Order.

B. Temporary Water Service: Install water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use.

1. Sterilization: Sterilize temporary water piping prior to use.

C. Temporary Water Service: The Owner will provide water for construction purposes from the existing building system. All required temporary extensions shall be provided and removed by the Contractor. Connection points and methods of connection shall be designated and approved by the Construction Representative.

D. Temporary Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnects, automatic ground-fault interrupters, and main distribution switch gear.

1. Install electric power service underground, except where overhead service must be used.

2. Power Distribution System: Install wiring overhead and rise vertically where least exposed to damage. Where permitted, wiring circuits not exceeding 125V, AC 20ampere rating, and lighting circuits may be nonmetallic sheathed cable where overhead and exposed for surveillance.

E. Temporary Electric Power Service: The Owner will provide electric power for construction lighting and power tools. Contractors using such services shall pay all costs of temporary services, circuits, outlet, extensions, etc.

F. Temporary Lighting: When overhead floor or roof deck has been installed, provide temporary lighting with local switching.

1. Install and operate temporary lighting that will fulfill security and protection requirements without operating the entire system. Provide temporary lighting that will provide adequate illumination for construction operations and traffic conditions.

G. Temporary Heating: Provide temporary heat required by construction activities for curing or drying of completed installations or for protection of installed construction from adverse effects of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy.

1. Heating Facilities: Except where the Owner authorizes use of the permanent system, provide vented, self-contained, LP gas or fuel-oil heaters with individual space thermostatic control.

2. Use of gasoline-burning space heaters, open flame, or salamander heating units is prohibited.

H. Temporary Heating and Cooling: The normal heating and/or cooling system of the building shall be maintained in operation during the construction. Should the Contractor find it necessary to interrupt the normal HVAC service to spaces, which have not been vacated for construction, such interruptions shall be pre-scheduled with the Construction Representative.

I. Temporary Telephones: Provide temporary telephone service throughout the construction period for all personnel engaged in construction activities.

1. Telephone Lines: Provide telephone lines for the following:
    a. Where an office has more than two (2) occupants, install a telephone for each additional occupant or pair of occupants.
    b. Provide a dedicated telephone for a fax machine in the field office.
    c. Provide a separate line for the Owner's use.
2. At each telephone, post a list of important telephone numbers.

J. Temporary Telephones: The Owner will provide telephones within the facility. All construction personnel will be allowed access only to those specific telephones designated by the Construction Representative.

K. Temporary Toilets: Install self-contained toilet units. Use of pit-type privies will not be permitted. Comply with regulations and health codes for the type, number, location, operation, and maintenance of fixtures and facilities. Install where facilities will best serve the Project's needs.
1. Shield toilets to ensure privacy.
2. Provide separate facilities for male and female personnel.
3. Provide toilet tissue materials for each facility.

L. Temporary Toilets: Use of the Owner's existing toilet facilities will be permitted, so long as facilities are cleaned and maintained in a condition acceptable to the Owner. All construction personnel will be allowed access only to those specific facilities designed by the Construction Representative. At substantial completion, restore these facilities to the condition prevalent at the time of initial use.

M. Temporary Toilets: The Owner will provide toilets and associated facilities within the building. All construction personnel will be allowed access only to those specific facilities designated by the Construction Representative.

N. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up for a health and sanitary condition. Dispose of drainage properly. Supply cleaning compounds appropriate for each condition.
1. Provide paper towels or similar disposable materials for each facility.
2. Provide covered waste containers for used material.
3. Provide safety showers, eyewash fountains, and similar facilities for convenience, safety, and sanitation of personnel.

O. Wash Facilities: The Owner will provide wash facilities within the building. All construction personnel will be allowed access only to those specific facilities designated by the Construction Representative.

P. Drinking-Water Facilities: Provide drinking-water fountains where indicated, including paper cup supply.

Q. Drinking-Water Facilities: Provide containerized, tap-dispenser, bottled-water drinking-water units, including paper supply.
1. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45°F to 55°F (7°C to 13°C).

R. Drinking-Water Facilities: The Owner will provide drinking water facilities within the building. All construction personnel will be allowed access only to those specific facilities designated by the Construction Representative.

S. Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of storm water from heavy rains.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Locate field offices, storage sheds, and other temporary construction and support facilities for easy access.

1. Maintain support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.

B. Field Offices: Provide insulated, weathertight temporary offices of sufficient size to accommodate required office personnel at the Project site. Keep the office clean and orderly for use for small progress meetings. Furnish and equip office as follows:

1. Furnish with a desk and chairs, a 4-drawer file cabinet, plan table, plan rack, and a 6-shelf bookcase.

2. Equip with a water cooler and private toilet complete with water closet, lavatory, and medicine cabinet unit with a mirror.

C. Storage facilities: Install storage sheds sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility service. Sheds may be open shelters or fully enclosed spaces within the building or elsewhere onsite.

D. Storage Facilities: Limited areas for storage of building materials are available onsite. Available storage areas are shown on the drawings. The Contractor shall provide his own security. Specific locations for storage and craning operations will be discussed at the Pre-Bid Meeting and the Pre-Construction Meeting.

E. Storage Facilities: The Owner will provide storage onsite as designated by the Facility Representative or the Construction Representative. Areas for use by the Contractor for storage will be identified at the Pre-Bid Meeting.

F. Storage Facilities: No areas for storage of building materials can be made available onsite except for on the roof. Loads shall not exceed the loading limits as stated on the drawings. Roofing materials must be craned onto the roof from dedicated parking spaces as arranged by the Contractor with the City; costs of all such arrangements shall be paid by the Contractor. The Contractor shall provide his own security as he finds necessary. Specific locations for storage and craning operations will be discussed at the Pre-Bid Meeting and the Pre-Construction Meeting.

G. Storage Facilities: No areas for storage of building materials can be made available onsite. The Contractor shall provide for all storage offsite. All off-site storage locations shall be approved by the Construction Representative. The Contractor shall provide his own security as he finds necessary. The Construction Representative shall have access to the off-site storage at all times.

H. Temporary Paving: Construct and maintain temporary roads and paving to support the indicated loading adequately and to withstand exposure to traffic during the construction period. Locate temporary paving for roads, storage areas, and parking where the same permanent facilities will be located. Review proposed modifications to permanent paving with the Designer.

1. Paving: Comply with Division 2 Section "Hot-Mixed Asphalt Paving" for construction and maintenance of temporary paving.

2. Coordinate temporary paving development with subgrade grading, compaction, installation and stabilization of subbase, and installation of base and finish courses of permanent paving.

3. Install temporary paving to minimize the need to rework the installations and to result in permanent roads and paved areas without damage or deterioration when occupied by the Owner.

4. Delay installation of the final course of permanent asphalt concrete paving until immediately before Substantial Completion. Coordinate with weather conditions to avoid unsatisfactory results.

5. Extend temporary paving in and around the construction area as necessary to accommodate delivery and storage of materials, equipment usage, administration, and supervision.

I. Construction Parking: Parking at the site will be provided in the areas designated at the Pre-Construction Meeting.

J. Construction Parking: Contractors must be prepared to discuss their storage and parking needs at the Pre-Bid Meeting. Parking for construction personnel cannot be provided onsite. All parking will be offsite. The Contractor will have to park on the street, in city-owned lots, or in commercial lots. Under no circumstances will any vehicle be parked in a fire lane. Parking on lawns shall be prohibited.

K. Dewatering Facilities and Drains: For temporary drainage and dewatering facilities and operations not directly associated with construction activities included under individual Sections, comply with dewatering requirements of applicable Division 2 Sections. Where feasible, utilize the same facilities. Maintain the site, excavations, and construction free of water.

L. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities.

1. Where heat is needed and the permanent building enclosure is not complete, provide temporary enclosures where there is no other provision for containment of heat. Coordinate enclosure with ventilating and materials drying or curing requirements to avoid dangerous conditions and effects.

2. Install tarpaulins securely with incombustible wood framing and other materials. Close openings of 25SqFt (2.3SqM) or less with plywood or similar materials.

3. Close openings through floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction.

4. Where temporary wood or plywood enclosure exceeds 100SqFt (9.2SqM) in area, use UL-labeled, fire-retardant-treated material for framing and main sheathing.

M. Temporary Lifts and Hoists: Provide facilities for hoisting materials and employees. Truck cranes and similar devices used for hoisting materials are considered “tools and equipment” and not temporary facilities.

N. Temporary Elevator Use: Refer to Division 14 for Elevators.

O. Temporary Elevator Use: The Owner will allow use of elevators within the building. All construction personnel will be allowed access only to those specific elevators designated by the Construction Representative.

P. Project Identification and Temporary Signs: Prepare project identification and other signs of size indicated. Install signs where indicated to inform the public and persons seeking entrance to the Project. Support on posts or framing of preservative-treated wood or steel. Do not permit installation of unauthorized signs.

1. Project Identification Signs: Engage an experienced sign painter to apply graphics. Comply with details indicated.

2. Temporary Signs: Prepare signs to provide directional information to construction personnel and visitors.

Q. Temporary Exterior Lighting: Install exterior yard and sign lights so signs are visible when Work is being performed.

R. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than seven (7) days during normal weather or three (3) days when the temperature is expected to rise above 80°F (27°C). Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material lawfully.

S. Rodent Pest Control: Before deep foundation work has been completed, retain a local exterminator or pest control company to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests. Employ this service to perform extermination and control procedures are regular intervals so the Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

T. Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate. Cover finished, permanent stairs with a protective covering of plywood or similar material so finishes will be undamaged at the time of acceptance.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer, as requested by the Designer.

B. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of the types needed to protect against reasonable predictable and controllable fire losses. Comply with NFPA 10 “Standard for Portable Fire Extinguishers” and NFPA 241 “Standard for Safeguarding Construction, Alterations, and Demolition Operations”.

1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one (1) extinguisher on each floor at or near each usable stairwell.

2. Store combustible materials in containers in fire-safe locations.

3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for fighting fires. Prohibit smoking in hazardous fire-exposure areas.

4. Provide supervision of welding operations, combustion-type temporary heating units, and similar sources of fire ignition.

C. Permanent Fire Protection: At the earliest feasible date in each area of the Project complete installation of the permanent fire-protection facility including connected services and place into operation and use. Instruct key personnel on use of facilities.

D. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting including flashing red or amber lights.

E. Enclosure Fence: Before excavation begins, install an enclosure fence with lockable entrance gates. Locate where indicated, or enclose the entire site or the portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering the site, except by the entrance gates.

1. Provide open-mesh, chainlink fencing with posts set in a compacted mixture of gravel and earth.

2. Provide plywood fence, 8’ (2.5m) high, framed with (4) 2”x4” (50mm x 100mm) rails, and preservative-treated wood posts spaced not more than 8’ (2.5m) apart.

F. Covered Walkway: Erect a structurally adequate, protective covered walkway for passage of persons along the adjacent public street. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction.

1. Construct covered walkways using scaffold or shoring framing. Provide wood plank overhead decking, protective plywood enclosure walls, handrails, barricades, warning signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage. Extend the back wall beyond the structure to complete the enclosure fence. Paint and maintain in a manner acceptable to the Owner and the Designer.

G. Security Enclosure and Lockup: Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

1. Storage: Where materials and equipment must be stored and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.

H. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and minimize the possibility that air, waterways, and subsoil might be contaminated or

polluted or that other undesirable effects might result. Avoid use of tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near the site.

3.5 OPERATION, TERMINATION AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.

B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

2. Protection: Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

C. Termination and Removal: Unless the Designer requests that it be maintained longer, remove each temporary facility when the need has ended, when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are the Contractor's property. The Owner reserves the right to take possession of project identification signs.

2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where the area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil in the area. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at the temporary entrances as required by the governing authority.

3. At Substantial Completion, clean and renovate permanent facilities used during the construction period including, but not limited to, the following:

a. Replace air filters and clean inside of ductwork and housing.

b. Replace significantly worn parts and parts subject to unusual operating conditions.

c. Replace lamps burned out or noticeably dimmed by hours of use.

END OF SECTION 015000

SECTION 017400 – CLEANING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for cleaning during the Project.

B. Environmental Requirements: Conduct cleaning and waste-disposal operations in compliance with local laws and ordinances. Comply fully with federal and local environmental and anti-pollution regulations.

1. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains.

2. Burning or burying of debris, rubbish, or other waste material on the premises is not permitted.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by the manufacturer or fabricator for the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 PROGRESS CLEANING

A. General

1. Retain all stored items in an orderly arrangement allowing maximum access, not impending drainage or traffic, and providing the required protection of materials.

2. Do not allow the accumulation of scrap, debris, waste material, and other items not required for construction of this Work.

3. At least twice each month, and more often if necessary, completely remove all scrap, debris, and waste material from the jobsite.

4. Provide adequate storage for all items awaiting removal from the jobsite, observing all requirements for fire protection and protection of the ecology.

B. Site

1. Daily, inspect the site and pick up all scrap, debris, and waste material. Remove all such items to the place designated for their storage.

2. Weekly, inspect all arrangements of materials stored onsite. Re-stack, tidy, or otherwise service all material arrangements.

3. Maintain the site in a neat and orderly condition at all times.

C. Structures

1. Daily, inspect the structures and pick up all scrap, debris, and waste material. Remove all such items to the place designated for their storage.

2. Weekly, sweep all interior spaces clean. "Clean" for the purposes of this paragraph, shall be interpreted as meaning free from dust and other material capable of being removed by use of reasonable effort and handheld broom.

3. In preparation for installation of succeeding materials, clean the structures or pertinent portions thereof to the degree of cleanliness recommended by the manufacturer of the succeeding material, using all equipment and materials required to achieve the required cleanliness.

4. Following the installation of finish floor materials, clean the finish floor daily while work is being performed in the space in which finish materials have been installed. "Clean" for the purposes of this subparagraph, shall be interpreted as meaning free from all foreign material which, in the opinion of the Construction Representative, may be injurious to the finish of the finish floor material.

3.2 FINAL CLEANING

A. General: Provide final cleaning operations when indicated. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit of Work to the condition expected from a commercial building cleaning and maintenance program. Comply with manufacturer's instructions.

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

1. Clean the Project Site, yard and grounds, in areas disturbed by construction activities including landscape development areas, of rubbish, waste material, litter, and foreign substances.

2. Sweep paved areas broom clean. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.

3. Remove petrochemical spills, stains, and other foreign deposits.

4. Remove tools, construction equipment, machinery, and surplus material from the site.

5. Remove snow and ice to provide safe access to the building.

6. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.

7. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.

8. Broom clean concrete floors in unoccupied spaces.

9. Vacuum clean carpet and similar soft surfaces removing debris and excess nap. Shampoo, if required.

10. Clean transparent material, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-

obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.

11. Remove labels that are not permanent labels.

12. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

    a. Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

13. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

14. Clean plumbing fixtures to a sanitary condition free of stains, including stains resulting from water exposure.

15. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.

16. Clean ducts, blowers, and coils if units were operated without filters during construction

17. Clean food-service equipment to a sanitary condition, ready and acceptable for its intended use.

18. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs and defective and noisy starters in fluorescent and mercury vapor fixtures.

19. Leave the Project clean and ready for occupancy.

C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid the Project of rodents, insects, and other pests. Comply with regulations of local authorities.

D. Removal of Protection: Remove temporary protection and facilities installed during construction to protect previously completed installations during the remainder of the construction period.

E. Compliances: Comply with governing regulations and safety standards for cleaning operations. Remove waste materials from the site and dispose of lawfully.

1. Where extra materials of value remain after Final Acceptance by the Owner, they become the Owner's property.

END OF SECTION 017400

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 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.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Demonstration and training video recordings.

1.3 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

B. Attendance Record: For each training module, submit list of participants and length of instruction time.

C. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.

1. Identification: On each copy, provide an applied label with the following information:

a. Name of Project.
b. Name and address of videographer.
c. Name of Architect.
d. Name of Construction Manager.
e. Name of Contractor.
f. Date of video recording.

2. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.

3. At completion of training, submit complete training manual(s) for Owner's use in PDF electronic file format on compact disc.

1.5 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative experienced in operation and maintenance procedures and training.

C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Coordination". Review methods and procedures related to demonstration and training including, but not limited to, the following:

1. Inspect and discuss locations and other facilities required for instruction.
2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
3. Review required content of instruction.
4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.6 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

a. System, subsystem, and equipment descriptions.
b. Performance and design criteria if Contractor is delegated design responsibility.
c. Operating standards.
d. Regulatory requirements.
e. Equipment function.
f. Operating characteristics.
g. Limiting conditions.
h. Performance curves.

2. Documentation: Review the following items in detail:

a. Emergency manuals.
b. Operations manuals.
c. Maintenance manuals.
d. Project record documents.
e. Identification systems.
f. Warranties and bonds.
g. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

a. Instructions on meaning of warnings, trouble indications, and error messages.
b. Instructions on stopping.
c. Shutdown instructions for each type of emergency.
d. Operating instructions for conditions outside of normal operating limits.
e. Sequences for electric or electronic systems.
f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

a. Startup procedures.
b. Equipment or system break-in procedures.
c. Routine and normal operating instructions.
d. Regulation and control procedures.
e. Control sequences.
f. Safety procedures.
g. Instructions on stopping.
h. Normal shutdown instructions.
i. Operating procedures for emergencies.
j. Operating procedures for system, subsystem, or equipment failure.
k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:

a. Alignments.
b. Checking adjustments.
c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

    a. Diagnostic instructions.
    b. Test and inspection procedures.

7. Maintenance: Include the following:

    a. Inspection procedures.
    b. Types of cleaning agents to be used and methods of cleaning.
    c. List of cleaning agents and methods of cleaning detrimental to product.
    d. Procedures for routine cleaning
    e. Procedures for preventive maintenance.
    f. Procedures for routine maintenance.
    g. Instruction on use of special tools.

8. Repairs: Include the following:

    a. Diagnosis instructions.
    b. Repair instructions.
    c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
    d. Instructions for identifying parts and components.
    e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 007213 "General Conditions".

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
2. Owner will furnish an instructor to describe Owner's operational philosophy.
3. Owner will furnish Contractor with names and positions of participants.

B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner with at least seven days' advance notice.

C. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

D. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Video: Provide minimum 640 x 480 video resolution converted to format file type acceptable to Owner, on electronic media.

1. Electronic Media: Read-only format compact disc acceptable to Owner, with commercial-grade graphic label.
2. File Hierarchy: Organize folder structure and file locations according to project manual table of contents. Provide complete screen-based menu.
3. File Names: Utilize file names based upon name of equipment generally described in video segment, as identified in Project specifications.
4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the Equipment Demonstration and Training DVD that describes the following for each Contractor involved on the Project, arranged according to Project table of contents:

    a. Name of Contractor/Installer.
    b. Business address.
    c. Business phone number.
    d. Point of contact.
    e. E-mail address.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.

1. Film training session(s) in segments not to exceed 15 minutes.

    a. Produce segments to present a single significant piece of equipment per segment.
    b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
    c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.

D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.

1. Furnish additional portable lighting as required.

E. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed.

F. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.

G. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION 017900

SECTION 200548 - SEISMIC CONTROLS FOR MEPFT SYSTEMS

PART 1 - GENERAL REQUIREMENTS

1.1 SECTION INCLUDES

A. This section includes requirements for seismic controls to be installed for project, the design for which is a delegated design responsibility.

1.2 DEFINITIONS

A. Section Title: Seismic Controls for Mechanical, Electrical, Plumbing, Fire Protection, and Technology (MEPFT).

B. ASCE: American Society of Civil Engineers.

C. Component Importance Factor: As defined in ASCE 7-latest edition, Chapter 13.

D. IBC: International Building Code.

E. ICC-ES: ICC-Evaluation Service.

F. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.3 ADMINISTRATIVE REQUIREMENTS

A. The contractor shall be responsible for determining the requirements for seismic control measures to be applied to HVAC piping and equipment, electrical conduit and raceways, electrical switchgear and plumbing systems specified herein. Seismic protection criteria used to determine seismic control requirements of all mechanical, electrical and plumbing systems shall be determined by the applicable code adopted in the project jurisdiction. Where not already determined within the contract documents, the contractor shall be responsible for contracting a licensed professional engineer to establish building site class, seismic use group, occupancy category, seismic design category, seismic zone or any other criteria necessary to determine the requirements for seismic control measures for mechanical, electrical and/or plumbing systems.

B. Where required, the Contractor shall be responsible for determining the type and location of seismic supports required for the HVAC piping and equipment, electrical conduit and raceways and plumbing elements shown on the contract drawings based on the seismic criteria, the size and weight of the supported element and the distance from structure that the element will be installed. The Contractor shall submit shop drawings as defined in Paragraph “Submittals” showing the types and locations of required seismic supports.

C. The requirements for seismic control measures to be applied to HVAC piping and equipment, electrical conduit and raceways, electrical switchgear and plumbing systems specified herein are in addition to any other items called for in other sections of these specifications. All anchor connections to structure for support of mechanical/electrical equipment, regardless of the need for seismic restraints, shall be shown on shop drawings and submitted for review by the Engineer of Record.

D. At the Contractor’s option, use pre-engineered seismic restraints produced by the manufacturers specified in part 2.1 of this section. Spacing of seismic restraints may be

modified in these pre-engineered systems to meet seismic design parameters when properly engineered and documented.

E. All seismic restraints, isolators, and isolation materials shall be of the same manufacturer and shall be certified by the manufacturer.

F. Seismic protection systems shall be installed in strict accordance with all applicable local, state, and/or federal codes. Installation shall also be in strict accordance with component manufacturer's requirements and standards and with industry construction standards. Whenever conflicts occur between codes or standards, the most stringent shall apply.

G. Seismic protection of fire protection piping systems shall be installed in strict accordance with the provisions of NFPA 13 (2010 or later edition).

1.4 SUBMITTALS

A. Seismic Control Measure Analysis: The contractor shall provide an analysis determining the requirement or exemption for seismic control measures for mechanical, electrical and plumbing equipment. The analysis shall be signed and sealed by a licensed professional structural engineer.

1. The analysis shall at a minimum include the following:
    a. For projects permitted under Uniform Building Code
        1) UBC Seismic Zone
        2) Seismic Zone Factor
        3) Occupancy Category
    b. For projects permitted under International Building Code
        1) Seismic Use Group or Building Category.
        2) Seismic Design Category
        3) Site Class
        4) Design Spectral Response Acceleration Values
    c. For projects with equipment mounted outdoors and subject to wind restraint requirements:
        1) Basic Wind Speed.
        2) Building Classification Category
        3) Minimum 10lb/sq. ft. multiplied by maximum area of HVAC component projected on vertical plane normal to wind direction and 45 degrees either side of normal.

B. Where seismic control measure analysis determines seismic controls are not required:

1. Submit report that summarizes the analysis for review and approval.
2. Disregard the remaining portions of this submittal section

C. Where seismic control measure analysis determines seismic controls are required:

1. Submit report that summarizes the analysis for review and approval

2. Provide submittals for seismic bracing as required in the remaining portions of this submittal section.

D. Product Data: The manufacturer of vibration isolation and seismic restraints shall provide submittals for products as follows:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.

2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.

a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.

b. Annotate to indicate application of each product submitted and compliance with requirements.

3. Restrained-Isolation Devices: Include ratings for horizontal, vertical, and combined loads.

E. Delegated-Design Submittal: Submit seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation. Design of seismic restraint components shall meet the requirements of ASCE 7.

1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic and wind forces required to select vibration isolators and seismic restraints.

a. Coordinate design calculations with wind-load calculations required for equipment mounted outdoors. Comply with requirements in other sections for equipment mounted outdoors.

2. Indicate materials and dimensions and identify hardware, including attachment and anchorage devices.

3. Seismic and Wind Restraint Details:

a. Design Analysis: Submit report that supports selection and arrangement of seismic and wind restraints. Include calculations of combined tensile and shear loads.

b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events.

c. Preapproval and Evaluation Documentation: Where required provide preapproval documentation from an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

F. Shop Drawings: The following items shall be signed and sealed by a registered professional engineer:

1. Shop drawings along with catalog cuts, templates, erection, and installation details, as appropriate, for the items listed below shall be submitted for approval.

Submittals shall be complete in detail; shall indicate thickness, type, grade, class of metal, and dimensions; and shall show construction details, reinforcement, anchorage, and installation with relation to other building systems and construction.

a. Sway Braces

b. Flexible Couplings or Joints

c. Resilient Type Vibration Devices

d. Equipment Anchor Connections

e. Fabrication details for equipment bases including dimensions, structural member sizes and support point locations.

f. Details of suspension and support for ceiling hung equipment.

g. Where walls, floors, slabs or supplementary steel work are used for seismic restraint locations, details of acceptable attachment methods for ducts, conduit and pipe must be included and approved before the condition is accepted for installation. Restraint manufacturers' submittals must include spacing, static loads and seismic loads at all attachment and support points.

h. Provide specific details of seismic restraints and anchors; include number, size and locations for each piece of equipment.

2. Layout drawings showing locations and types of seismic restraints for all equipment, ductwork, piping and conduit shall be submitted. Locations for seismic restraints shall be coordinated with the structure and with other mechanical and electrical components. Coordinate types of restraints with the submitted schedule

3. Indicate components exempt from seismic due to exceptions for component importance factor, component response modification factor, component amplification factor, seismic design category, etc.

G. Seismic Certification and Analysis:

1. Seismic restraint calculations shall be provided for all connections of equipment to the structure. Calculations shall be stamped by a registered professional engineer with at least five years of seismic design experience, licensed in the state of the project location.

2. All restraining devices shall have a preapproval number from California OSHPD or some other recognized government agency showing maximum restraint ratings. Preapprovals based on independent testing are preferred to preapprovals based on calculations. Where preapproved devices are not available, submittals based on independent testing are preferred. Testing and calculations shall include shear and tensile loads as well as one test or analysis at 45° to the weakest mode.

3. Analysis shall indicate calculated dead loads, static seismic loads and capacity of materials utilized for connections to equipment and structure. Analysis must detail anchoring methods, bolt diameter, embedment and/or welded length. All seismic restraint devices shall be designed to accept, without failure, the code required forces acting through the equipment center of gravity. Overturning moments may exceed forces at ground level.

4. Submit certification letter stating that the special inspector has received the factory training necessary to perform the field inspection specified in Part 3 of this specification.

H. Welding certificates.

1.5 QUALITY ASSURANCE

A. Professional Engineer Qualifications (Analysis): The professional engineer shall be licensed to practice in the jurisdiction where the project is located and shall be experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for building structural and seismic requirements.

B. Professional Engineer Qualifications (Design): The professional engineer shall be legally qualified to practice in the jurisdiction where the Project is located and shall be experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of vibration isolation bases and seismic restraints that are similar to those indicated for this Project in material, design, and extent.

C. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

D. Seismic Restraint Manual: A seismic restraint manual shall be prepared that contains the basis of the design for the seismic support systems, product data, shop drawings and layout drawings. A copy of the seismic restraint manual shall be kept on the jobsite for the duration of the project.

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

F. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

G. ASCE 7: Provide seismic restraint systems meeting the requirements of ASCE 7 - latest edition “Minimum Design Loads for Buildings and Other Structures”; Chapter 13, “Seismic Design Requirements for Nonstructural Components.”

H. Comply with NFPA 70.

1.6 SPECIAL INSPECTION

A. Requirements specified herein for special inspection of important aspects of the seismic design are in addition to other requirements specified in other sections of this specification.

1.7 ELECTRICAL EQUIPMENT

A. Electrical equipment to be protected shall include the following items to the extent required on the drawings or in other sections of these specifications:

1. Major Electrical Distribution Equipment including but not limited to

a. Panelboards

b. Switchgear

c. Transformers

d. Freestanding Disconnect

e. Control equipment (time-clocks, contactor enclosures, etc.)

2. Electrical Conduit and Raceways

1.8 PLUMBING EQUIPMENT

A. Plumbing equipment to be protected shall include the following items to the extent required on the drawings or in other sections of these specifications:

1. Fuel Gas piping

2. Fuel Oil Piping

1.9 RELATED WORK

A. Housekeeping Pads

1. The restraint vendor shall prepare housekeeping pad reinforcement and monolithic pad attachment to the structure details and design.

2. Housekeeping pads shall be coordinated with restraint vendor and sized to provide a minimum edge distance of ten (10) bolt diameters all around the outermost anchor bolt to allow development of full drill-in wedge anchor ratings. If cast-in anchors are to be used, the housekeeping pads shall be sized to accommodate the ACI requirements for bolt coverage and embedment.

B. Supplementary Support Steel

1. Contractor shall supply supplementary support steel for all equipment, piping, ductwork, etc., as required or specified.

1.10 ATTACHMENTS

A. Contractor shall supply restraint attachment plates cast into housekeeping pads, concrete inserts, double sided beam clamps, etc. in accordance with the requirements of the seismic vendor's calculations.

PART 2 - PRODUCTS AND MATERIALS

2.1 MANUFACTURERS

A. Seismic Restraints: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following or approved equals:

1. Amber/Booth Company, Inc.
2. B-Line / Tolco.
3. International Seismic Application Technology (ISAT).
4. Kinetics Noise Control, Inc.
5. Loos & Company, Inc.
6. Mason Industries, Inc.
7. Uni-Strut.
8. Vibro-Acoustics.

B. Flexible Couplings: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following or approved equals:

1. Barco Div.
2. Flexonics, Inc.
3. Hyspan.
4. International Seismic Application Technology (ISAT).
5. Mason Industries, Inc.
6. Resistoflex.

2.2 VIBRATION ISOLATORS

A. Isolator Pads: Oil and water resistant and factory cut to sizes that match requirements of the equipment supported.

1. Rubber Isolator Pads: Elastomer (neoprene or silicone) arranged in single or multiple layers and molded with a nonslip pattern and steel baseplates of sufficient stiffness to provide uniform loading over the pad area.
2. Fiberglass or cork isolator pads: molded cork or glass fiber not less than 1 inch thick and pre-compressed through 10 compression cycles at 3 times the rated load.
3. Load range: from 10 to 50 psig and a deflection not less than 0.08 inch per 1 inch of thickness. Do not exceed a loading of 50 psig.

B. Rubber Isolator Mounts: Double-deflection type, with molded, oil-resistant rubber or neoprene isolator elements, with encapsulated top- and baseplates. Factory-drilled and tapped top plate for bolted equipment mounting. Factory-drilled baseplate for bolted connection to structure. Color-code to indicate capacity range.

C. Spring Isolators: Freestanding, laterally stable, open-spring-type isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 1.0 times the rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

5. Baseplates: Factory drilled for bolting to structure and bonded to a 1/4-inch thick, rubber isolator pad attached to the baseplate underside. Size baseplates to limit floor loading to the structural design criteria. Contact the Engineer if design criteria is not shown on the drawings.

6. Top Plates: Provide threaded studs for fastening and leveling equipment.

7. Finishes: Manufacturer's standard corrosive-resistant finish.

D. Restrained Spring Isolators: Vertically restrained, freestanding, laterally stable, steel open-spring-type isolators.

1. Housing: Welded steel with resilient vertical limit stops to prevent spring extension due to wind loads or when weight is removed. Factory-drilled baseplate for bolting to structure and bonded to a 1/4-inch thick, rubber isolator pad attached to the baseplate underside. Provide adjustable equipment mounting and leveling bolt.

2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

3. Minimum Additional Travel: 50 percent of the required deflection at rated load.

4. Lateral Stiffness: More than 0.8 times the rated vertical stiffness.

5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

6. Finishes: Baked enamel for metal components on isolators for interior use. Hot-dip galvanized for metal components on isolators for exterior use.

E. Rubber Hangers: Double-deflection type, with molded, oil-resistant rubber or neoprene isolator elements bonded to formed-steel housings with threaded connections for hanger rods. Color-code to indicate capacity range.

F. Spring Hangers: Combination spring and elastomeric hanger with coil spring and elastomeric insert in compression.

1. Frame: Formed steel, fabricated for connection to threaded rods and to allow for 30 degrees of angular hanger rod misalignment without binding or reducing isolation efficiency.

2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

3. Minimum Additional Travel: 50 percent of the required deflection at rated load.

4. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Install elastomeric grommet at bottom connection for isolation between anchor bolt and base plate or housing.

5. Finishes: Baked enamel for metal components. Color-code to indicate capacity range.

2.3 SEISMIC CONTROLS

A. Thrust Restraints: Combination spring and elastomeric restraints with coil spring and elastomeric insert in compression. Factory set for thrust.

1. Frame: Formed steel, fabricated for connection to threaded rods and to allow for 30 degrees of angular hanger rod misalignment without binding or reducing isolation efficiency.

2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

3. Minimum Additional Travel: 50 percent of the required deflection at rated load.

4. Elastomeric Element: Molded, oil-resistant rubber or neoprene.

5. Finishes: Baked enamel for metal components. Color-code to indicate capacity range.

B. Manufactured Seismic Snubbers: All-directional snubbers.

1. Construction: Interlocking steel members restrained by a 3/4-inch- thick, replaceable, shock-absorbing neoprene insert. Maintain 1/8-inch clearance in all directions between rigid and resilient surfaces.

C. Fabricated Seismic Snubbers: Welded structural-steel shapes designed and fabricated to restrain equipment or vibration isolation bases from excessive movement during a seismic event. Design to resist gravity forces identified by authorities having jurisdiction.

1. Construction: Welded steel shapes conforming to ASTM A 36.

2. Resilient Components: 3/4-inch thick, replaceable, shock-absorbing neoprene insert.

2.4 VIBRATION ISOLATION BASES

A. Fabricated Steel Bases: Structural-steel bases and rails designed and fabricated by the isolation equipment manufacturer. Include equipment static loadings, power transmission, component misalignment, and cantilever loadings.

1. Fabricate bases to shapes required, with welded structural-steel shapes, plates, and bars conforming to ASTM A 36. Include support brackets to anchor base to isolation units. Include prelocated equipment anchor bolts and auxiliary motor slide bases or rails.

2. Design and fabricate bases to result in the lowest possible mounting height with not less than 1-inch clearance above the floor.

3. Concrete-Filled Inertia Bases: Weld reinforcing bars to the structural frame. Pour concrete into base with relocated equipment anchor bolts.

4. Weld steel angles on frame for outrigger isolation mountings, and provide for anchor bolts and equipment support.

5. Configure inertia bases to accommodate equipment supported.

6. Pump Bases: Size to support pump and piping elbows.

7. Factory Finish: Manufacturer's standard corrosive-resistant finish.

2.5 VIBRATION ISOLATION ROOF CURBS

A. Description: Factory-assembled, fully enclosed, insulated, air- and watertight curb designed to resiliently support roof-mounted equipment and to withstand 125-mph wind

impinging laterally against the side of the equipment. Design restraints to meet seismic requirements of authorities having jurisdiction.

B. Components: Upper support frame; lower support assembly; freestanding, unhoused, laterally stable steel springs; vertical and horizontal restraints.

1. Lower Support Assembly: Provide a means of attachment to the building structure and include a wood nailer strip for attachment of roof material and 2 inches of rigid insulation on the inside of the assembly.

2. Spring Isolators: As indicated or scheduled. Include adjustment bolt to permit leveling of equipment after installation. Attach to lower assembly with a rubber isolation pad. Locate spring isolators so they are accessible for adjustment at any time during the life of the installation without interfering with the integrity of the roof.

3. Water Seal: Elastomeric seal conforming to UL Class A roofing materials, attached to the upper support frame, extending down past the wood nailer of the lower support assembly, and counterflashed over the roof materials.

2.6 MATERIALS

A. Bolts and Nuts:

1. Squarehead bolts and heavy hexagon nuts, ANSI B18.2.1 and B18.2.2, and ASTM A307 or A 576.

2. Bolts, underground, ASTM A 325.

B. Sway Brace: Except for pipes, material shall be structural steel conforming to ASTM A 36. Steel pipes shall conform to ASTM A 501.

C. Flexible Couplings: Flexible couplings shall have same pressure ratings as adjoining pipe. Where required by these specifications, flexible couplings shall be one of the following:

1. Flexible ball joints conforming to the following requirements may be employed on aboveground piping. Joints shall have cast or wrought steel casing and ball parts capable of 360-degree rotation plus not less than 15-degree angular movement. Joints shall be certified to be suitable for the service intended by the manufacturer, based on not less than 2 years' satisfactory operation in a similar application.

2. Flexible metal hose type joints may be used for aboveground or underground piping, up to 8" pipe diameter. Where permitted in other sections of these specifications, joints utilizing split-half couplings with grooved or shouldered pipe ends may be used.

D. Resilient Vibration Isolation Devices:

1. Selection of anchor bolts for vibration isolation devices and/or snubbers to equipment base and foundations shall follow the same procedure as in paragraph "Anchor Bolts".

2. Multidirectional Seismic Snubbers: Multidirectional seismic snubbers employing elastomeric pads shall be installed on all floor or slab-mounted equipment. Snubbers shall provide 0.25 inches vertical and horizontal clearances. Vertical forces shall be resisted by the snubber medium. Provide additional structural steel supports/frame necessary for equipment to insure proper restraint.

3. Seismically Restrained Vibration Isolators: As an option to multidirectional seismic snubbers, a unitized adjustable open spring isolator and a welded steel housing designed to resist seismic forces in all directions may be utilized. Restraint surfaces which engage under seismic motion shall be cushioned with a resilient elastomer, neoprene or equal, to protect equipment.

4. Restraints shall allow a maximum of 1/4" movement before engaging and shall not interfere in normal operation. Housing shall allow for visual inspection of the spring. The entire assembly shall have a certified minimum rating of 1g. in all directions. Submit test data from independent testing lab.

5. Isolator shall be stable spring with a minimum Ky/Ky of 1.0 and the spring shall be isolated from the housing by an internal elastomeric pad on its base for sound absorption. Spring shall have a combination leveling bolt and equipment fastening device. Nuts and bolts shall be zone-electroplated to prevent corrosion. Adjusting bolt and equipment attachment shall have a minimum rating of 1g. Bolting equipment to isolator with bolts smaller than main adjusting bolt will not be allowed.

6. Baseplate shall have adequate means for bolting to the structure. If elastomeric pad for sound absorption is on baseplate of housing, anchor bolts shall be isolated with elastomeric grommets.

2.7 CABLE RESTRAINT

A. Restraint assembly for suspended equipment, piping and ductwork consisting of galvanized steel aircraft cable attached to galvanized steel thimbles or steel assemblies with two clamping bolts. Thimbles or assemblies shall be specifically designed for cable service, shall be able to swivel to final installation angle and shall be securely fastened to the equipment or equipment base and the building structure. Cables shall be sized for the force required per code with a minimum safety factor of 2.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General

1. Install and anchor seismic-control products according to manufacturer's written instructions and authorities having jurisdiction.

2. Anchor interior mounts, isolators, hangers, and snubbers to vibration isolation bases. Bolt isolator baseplates to structural floors as required by authorities having jurisdiction.

3. Anchor exterior mounts, isolators, hangers, and snubbers to vibration isolation bases. Bolt isolator baseplates to structural supports as required by authorities having jurisdiction.

4. Fill concrete inertia bases, after installing base frame, with 3000-psig concrete, and trowel to a smooth, hard finish.

5. Install pipe connectors at connections for equipment supported on vibration isolators.

6. Install cables to prevent excessive seismic motion and so arranged that they do not engage during normal operation.

B. Sway Braces for Piping, Conduit and Ducts

1. Sway braces shall be installed on piping, conduit and HVAC ducts to preclude damage during seismic activity. Provisions of this paragraph apply to all piping within a 5-foot line around outside of building unless buried in the ground. Piping grouped for support on trapeze-type hangers shall be braced at the same intervals as determined by the smallest diameter pipe of the group. No trapeze-type hanger shall be secured with less than two 1/2 inch bolts. Bracing rigidly attached to pipe flanges, or similar, shall not be used where is would interfere with thermal expansion of piping.

2. Sway Braces for Piping and Conduit:

   a. Horizontal Runs: Provide transverse and longitudinal sway bracing at intervals as required for the pipe size and seismic zone.

   b. Vertical Runs: Vertical runs of piping 1-1/2" or greater diameter shall be braced at not more than 10-foot vertical intervals. For piping smaller than 1-1/2" diameter, bracing shall be provided at no more than 4-foot spacing.

   c. Anchor Rods, Angles, and Bars: Anchor rods, angles, and bars shall be bolted to either pipe clamps or pipe flanges at one end and cast-in place concrete or masonry insert of clip angles bolted to the steel structure on the other end. Rods shall be solid metal or pipe as specified below. Anchor rods, angles, and bars shall not exceed lengths given in Table III.

   d. Clamps: Clamps on uninsulated pipes shall be applied directly to pipe. Insulated piping shall have clamps applied over insulation vapor barrier with high-density inserts and metal protection shields under each clamp.

   e. Bolts: Bolts used for attachment of anchors to pipe and structure shall be not less than 1/2 inch diameter.

3. Sway Braces for HVAC Ducts:

   a. Transverse Sway Bracing: Transverse sway bracing shall be provided at each horizontal turn of 45 degrees or more, at the end of each duct run, and otherwise at intervals as required for duct size and seismic zone. Walls which ducts penetrate may be considered transverse braces.

   b. Longitudinal Sway Bracing: Longitudinal sway bracing shall be provided at intervals as required for duct size and seismic zone. Transverse bracing for one duct section may also act as longitudinal bracing for a duct section connected perpendicular to it, if the bracing is installed within 4 feet of the intersection, and it is sized for the larger duct.

C. Piping and Conduit Penetration Requirements

1. All piping from 1 to 3-1/2 inches diameter shall be installed with 1" clearance on all sides and at every floor, and masonry or concrete wall penetration. A 2" clearance is required for pipe sizes larger than 3-1/2".

2. Insulated and uninsulated pipes and conduit passing through walls and partitions (except smoke and fire walls and partitions) shall be run through not less than No. 12 gauge steel pipe sleeves finishing flush with the finished wall surfaces. Where covered pipes pass through the walls or partitions, same shall be centered in steel pipe sleeves. All sleeves or thimbles shall be independent of the pipes they enclose and centered in sleeves to insure free movement of the pipes without injury to pipe

insulation, wall or other finish. Caulk around all pipes and pipe sleeves passing through walls or ceilings with untarred jute and make airtight and soundproof.

3. Insulated and uninsulated pipes and conduit passing through fire, or fire and smoke walls and partitions shall be run through rated wall sleeve assemblies sealed with UL approved sealant in accordance with its listing, meeting the approval of the authority having jurisdiction, and as indicated on details on drawings.

4. Pipe sleeves through outside walls shall be Schedule 40 steel pipe sleeves with 1-1/2"collar welded to center of sleeve and cast in wall. Caulk between sleeves and pipes and make watertight.

5. Materials and equipment shall conform to the respective specifications and other requirements specified below:

D. Spreaders

1. Provide spreaders between racked or adjacent piping runs to prevent contact during seismic activity whenever pipe or insulated pipe surfaces are less than 4 inches apart or four times the maximum displacement due to seismic force. Spreaders to be applied at same interval as sway braces. Spreaders shall be applied to surface of bare or insulated hot pipe and over insulation utilizing high-density inserts and pipe protection shields where vapor-barrier-type insulation is employed.

E. Flexible Couplings or Joints

1. Building Piping: Flexible couplings or joints in building piping shall be provided in the following locations on pipe risers:

   a. Within 24 inches of the top and bottom of all risers. This requirement may be deleted in risers less than 3 ft. in length, and in risers 3 to 7 ft. in length, one flexible coupling is adequate.

2. Underground Piping: All underground piping and 4-inch or larger conduit, except heat distribution system, shall have flexible couplings installed adjacent to building. Additional flexible couplings shall be provided as follows:

   a. On each side of the joints of demarcation between soils having widely differing degrees of consolidation.

   b. At all points that can be considered to act as anchors.

   c. On every branch of a tee and each side of an elbow.

F. Anchor Bolts

1. All floor or pad mounted equipment required by any Section of these specifications shall use cast-in-place or female wedge type anchor bolts. Anchor bolts must conform to ASTM A 307. Female wedge anchors shall have an evaluation report number from ICBA Evaluation Service. Anchor bolts shall have an embedded straight length equal to at least twelve times nominal diameter of the bolt. If the size and number of the anchor bolts are not shown on the drawings, then anchor bolts shall conform to the applicable codes and standards for the various equipment weights or the manufacturer's installation recommendations, whichever is the most stringent.

G. Equipment Sway Bracing

1. Provide for all items supported from overhead floor or roof structures with the following requirements:

   a. Braces shall consist of angles, rods, bars, or pipes secured at both ends with not less than 1/2 inch bolts. Braces shall conform to all applicable codes and standards. Bracing shall be provided in two planes of directions, 90 degrees apart, for each item of equipment. Sufficient braces shall be provided for equipment to resist a horizontal force equal to 50 percent of the weight of equipment without exceeding safe working stress of bracing components. Details of all equipment bracing shall be submitted for approval.

   b. In lieu of bracing with vertical supports, these items may be supported with hangers inclined at 45 degrees directed up and radially away from equipment and oriented symmetrically in 90 degree intervals on the horizontal plane, bisecting the angles of each corner of the equipment, provided that supporting members are properly sized to support operating weight of equipment when hangers are included at a 45 degree angle.

H. Ceiling mounted air terminals or services installed in lay-in ceilings

1. Positively attach to the ceiling suspension main runners or to cross runners with the same carrying capacity as the main runners.

2. Terminals or services weighing not more than 56 pounds, in addition to the above, shall have two No. 12 gauge hangers connected from the terminal or service or to the structure above. These wires may be slack.

3. Terminals or services weighing more than 56 pounds shall be supported directly from the structure above by approved hangers.

I. Miscellaneous Equipment

1. The following specific items of equipment to be furnished under this contract shall be constructed and assembled so as to be capable of withstanding the horizontal equivalent static force of 0.11 times the operating weight of the equipment, at vertical center of gravity of the equipment without causing permanent deformation, dislocations, separation of components, or other damage, which would render the equipment inoperative for significant periods of time following an earthquake.

   a. Air Handling Units

   b. Free Standing Electric Motors

J. Floor Mounted Equipment Support

1. Vibration Isolation Bases: Mount equipment on structural-steel bases or concrete inertia bases.

2. Snubbers: Install the required number of seismic snubbers on each spring-mounted piece of equipment. Locate snubbers as close as possible to the vibration isolators and bolt to supporting structure.

3.2 ADJUSTING AND CLEANING

A. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operations.

B. Adjust thrust restraints for a maximum of 1/4 inch of movement at start and stop.

3.3 SPECIAL INSPECTION

A. Special Inspector: Employ a factory trained representative during construction to observe the work specified and to ensure that it conforms to the Contract documents. Factory trained representative shall be a qualified person who shall demonstrate competence and specialized experience, to the satisfaction of the engineer of record, for inspection of the seismic protection of mechanical and electrical equipment.

B. Inspection Requirements: The factory trained representative shall periodically inspect the following systems to verify conformance with the contract documents and the local code:

1. Installation of piping systems intended to carry flammable, combustible or highly toxic contents and their associated mechanical units in structures assigned to Seismic Design Category C, D, E or F.
2. Installation of HVAC ductwork that will contain hazardous materials in structures assigned to Seismic Design Category C, D, E or F.
3. Installation of vibration isolation systems in structures assigned to Seismic Design Category C, D, E or F where a nominal clearance of 0.25 inches or less between the equipment support frame and restraint is required.

C. Inspection Reports: Ensure that the inspection report is furnished from the special inspector to the engineer of record. At the end of the work, ensure that a final, signed report is submitted by the special inspector, stating whether the work requiring special inspection was, to the best of the special inspector's knowledge, in conformance with the Contract documents.

D. Discrepancies: Discrepancies shall be brought to the immediate attention of the Contractor for correction, and then, if uncorrected, to the architect and engineer of record.

END OF SECTION 200548

SECTION 260010 - GENERAL ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section and to all following sections within Division 26.

1.2 SECTION INCLUDES

A. This Division requires providing complete functioning systems, and each element thereof, as specified, indicated, or reasonably inferred, on the Drawings and in these Specifications, including every article, device, or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the Work include, but are not limited to, materials, labor, supervision, supplies, tools, equipment, transportation and utilities.

B. Division 26 of these Specifications, and Drawings numbered with prefixes E, generally describe these systems, but the scope of the electrical work includes all such work indicated in all of the Contract Documents, including, but not limited to: Instructions to Bidders; Proposal Form; General Conditions; Supplementary General Conditions; Architectural, Structural, Mechanical, Plumbing and Electrical Drawings and Specifications; and Addenda.

C. Drawings are graphic representations of the Work upon which the Contract is based. The Contractor will show the materials and their relationship to one another, including sizes, shapes, locations, and connections. The Contractor also convey the scope of work, indicating the intended general arrangement of the equipment, fixtures, outlets and circuits without showing all of the exact details as to elevations, offsets, control lines, and other installation requirements. Use the Drawings as a guide when laying out the Work and to verify that materials and equipment will fit into the designated spaces, and which, when installed per manufacturers' requirements, will ensure a complete, coordinated, satisfactory and properly operating system.

D. Specifications define the qualitative requirements for products, materials, and workmanship upon which the Contract is based.

1.3 DEFINITIONS

A. Whenever used in these Specifications or Drawings, the following terms shall have the indicated meanings:

1. Furnish: "To supply and deliver to the project site, ready for unloading, unpacking, assembling, installing, and similar operations."

2. Install: "To perform all operations at the project site, including, but not limited to, and as required: unloading, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, testing, commissioning, starting up and similar operations, complete, and ready for the intended use."

3. Provide: "To furnish and install complete, and ready for the intended use."

4. Furnished by Owner (or Owner-Furnished) or Furnished by Others: “An item furnished by the Owner or under other Divisions or Contracts, and installed under the requirements of this Division, complete, and ready for the intended use, including all items and services incidental to the Work necessary for proper installation and operation. Include the installation under the warranty required by this Division.

5. Engineer: Where referenced in this Division, “Engineer” is the Engineer of Record and the Design Professional for the Work under this Division.

    a. A Consultant to, and an authorized representative of, the Owner, as defined in the General and/or Supplementary Conditions. When used in this Division, it means increased involvement by, and obligations to, the Engineer, in addition to involvement by, and obligations to, the “Owner”.

6. Contract Administrator: Where referenced in this Division, “Contract Administrator” is the primary liaison between the Owner and the Contractor. Specifically, for this project this is the “Engineer”.

7. AHJ: The local code and/or inspection agency (Authority) Having Jurisdiction over the Work.

8. NRTL: Nationally Recognized Testing Laboratory, as defined and listed by OSHA in 29 CFR 1910.7 (e.g., UL, ETL, CSA, etc.), and acceptable to the Authority having Jurisdiction (AHJ) over this project. Nationally Recognized Testing Laboratories and standards listed are used only to represent the characteristics required and are not intended to restrict the use of other NRTLs that are acceptable to the AHJ, and standards that meet the specified criteria.

9. Substitution: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor. Substitutions include Value Engineering proposals.

    a. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.

    b. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

10. Value Engineering: A systematic method to improve the “value” of goods and services by using an examination of function. Value, as defined, is the ratio of function to cost. Value can therefore be increased by either improving the function or reducing the cost. The goal of VE is to achieve the desired function at the lowest overall cost consistent with required performance.

11. Basis-of-Design Product: Subject to compliance with requirements, provide either the named product or a comparable product by one of the other equivalent manufacturers specified

B. When 'furnish', 'install', 'perform', or 'provide' is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of Contractor, "provide" is implied.

C. The terms "approved equal", “equivalent”, or "equal" are used synonymously and shall mean “accepted by or acceptable to the Engineer as equivalent to the item or manufacturer

specified". The term "approved" shall mean labeled, listed, or both, by an NRTL, and acceptable to the AHJ over this project.

D. Manufacturers: The listing of specific manufacturers does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed are not relieved from meeting these specifications in their entirety.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include but are not limited to, manufacturers specified.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

3. Where a list is provided, manufacturers are listed alphabetically and not in accordance with any ranking or preference, unless otherwise noted.

E. The following definitions apply to excavation operations:

1. Additional Excavation: Where excavation has reached indicated sub-grade elevations, if unsuitable bearing materials are encountered, continue excavation until suitable bearing materials are reached. The Contract Sum may be adjusted by an appropriate Contract Modification.

2. Sub-base: as used in this section refers to the compacted soil layer used in pavement systems between the sub-grade and the pavement base course material.

3. Sub-grade: as used in this section refers to the compacted soil immediately below the slab or pavement system.

4. Unauthorized excavation consists of removal of materials beyond indicated sub-grade elevations or dimensions without specific direction from the Contract Administrator.

1.4 REFERENCE STANDARDS

A. Execute all work in accordance with, and comply at a minimum with, National Fire Protection Association (NFPA) codes, state and local building codes, and all other applicable codes and ordinances in force, governing the particular class of work involved, for performance, workmanship, equipment, and materials. Additionally, comply with rules and regulations of public utilities and municipal departments affected by connection of services. Where conflicts between various codes, ordinances, rules, and regulations exist, comply with the most stringent. Wherever requirements of these Specifications, Drawings, or both, exceed those of the above items, the requirements of these Specifications, Drawings, or both, shall govern. Code compliance, at a minimum, is mandatory. Construe nothing in these Construction Documents as permitting work not in compliance, at a minimum, with these codes. Bring all conflicts observed between codes, ordinances, rules, regulations and these documents to the Contract Administrator's and Engineer's attention in sufficient time, prior to the opening of bids, to prepare the Supplementary Drawings and Specifications Addenda required to resolve the conflict.

B. If the conflict is not reported timely, prior to the opening of bids, resolve the conflict and provide the installation in accordance with the governing codes and to the satisfaction of the Contract Administrator and Engineer, without additional compensation. Contractor will be held responsible for any violation of the law.

C. Obtain timely inspections by the constituted authorities having jurisdiction; and, upon final completion of the Work, obtain and deliver to the Owner executed final certificates of acceptance from these authorities having jurisdiction.

D. All material, manufacturing methods, handling, dimensions, methods of installation, and test procedures shall conform to industry standards, acts, and codes, including, but not limited to the following, except where these Drawings and Specifications exceed them:

IBC	International Building Code
ADA	Americans with Disabilities Act
AEIC	Association of Edison Illuminating Companies
ANSI	American National Standards Institute
ASTM	American Society of Testing Materials
AWS	American Welding Society
AWWA	American Water Works Association
ICEA	Insulated Conductors Engineers Association
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society
NBFU	National Board of Fire Underwriters
NEC	National Electrical Code, NFPA 70
NECA	National Electrical Contractors Association
NEMA	National Electrical Manufactures' Association
NETA	InterNational Electrical Testing Association
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Act
UL	Underwriter's Laboratories

E. Comply with rules and regulations of public utilities and municipal departments affected by connections of services.

F. Perform all electrical work in compliance with applicable safety regulations, including OSHA regulations. All safety lights, guards, and warning signs required for the performance of the electrical work shall be provided by the Contractor.

G. Obtain and pay for all permits, licenses and fees that are required by the governing authorities for the performance of the electrical work.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with other divisions for electrical work included in them but not listed in Division 26 or indicated on electrical Drawings.

B. Visit the site and ascertain the conditions to be encountered in installing the Work under this Division, verify all dimensions and locations before purchasing equipment or commencing work, and make due provisions for same in the bid. Failure to comply with this requirement shall not be considered justification for omission, alteration, and incorrect or faulty installation of any of the Work under this Division or for additional compensation for any work covered by this Division.

C. Refer to Drawings and divisions of the other trades and to relevant equipment drawings and shop drawings to determine the extent of clear spaces. Make all offsets required to clear equipment, beams and other structural members, and to facilitate concealing conduit in the manner anticipated in the design.

D. 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.

E. Provide materials with trim that will fit properly the types of ceiling, wall, or floor finishes installed.

F. Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

G. Maintain an electrical foreman on the jobsite at all times to coordinate this work with other trades so that various components of the electrical systems is installed at the proper time, fits the available space, and allows proper service access to all equipment. Carry on the Work in such a manner that the Work of the other trades will not be handicapped, hindered, or delayed at any time.

H. Work of this Division shall progress according to the "Construction Schedule" as described in Division 01 and as approved by the Contract Administrator. Cooperate in establishing these schedules and perform the Work under this Division, in a timely manner in conformance with the construction schedule so as to ensure successful achievement of all schedule dates.

1.6 MEASUREMENTS AND LAYOUTS

A. The Drawings are schematic in nature but show the various components of the systems approximately to scale and attempt to indicate how they are to be integrated with other parts of the Work. Figured dimensions take precedence to scaled dimensions. Determine exact locations by job measurements, by checking the requirements of other trades, and by reviewing all Contract Documents. Correct, at no additional costs to the Owner, errors that could have been avoided by proper checking and inspection.

1.7 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to the requirements of individual Sections. Additionally, prepare coordination drawings as required scope of installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one trade.

1. Information shall be project specific and drawn accurately to a scale large enough to resolve conflicts. Do not base coordination drawings on standard dimensional data.

2. Prepare floorplans, sections, elevations, and details as needed to adequately describe relationship of various systems and components.

3. Clearly indicate functional and spatial relationships of components of all systems specified in the Contract Documents, including but not limited to: architectural, structural, civil, mechanical, electrical, fire protection, and specialty systems.

4. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.

5. Show location and size of access doors required for access to concealed equipment, fittings, controls, terminations, and cabling.

6. Indicate required installation sequence to minimize conflicts between entities.

7. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Contract Administrator indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

8. The details of the coordination are the responsibility of the Contractor and, where indicated on the Drawings, minor adjustments in raceway routing, device placement, device type, or equipment arrangement are not to be considered changes to the Contract.

B. Equipment Room Coordination Drawings: In accordance with the submittal procedures outlined within these Specifications, provide dimensioned layouts of electrical equipment locations within electrical rooms/closets, mechanical rooms, generator rooms, and fire pump rooms with equipment drawn to scale and identified therein.

1. Clearly identify all required working clearances and access provisions required for installation and maintenance.

2. Equipment layouts should be arranged accounting for considerations for required door openings and the clearances required by the equipment manufacturer.

3. Indicate path to allow for the future removal of each large piece of equipment (up to and including generators and unit sub-station transformers) without removal of non-related equipment or architectural elements.

4. Include work provided by others routed through the equipment rooms.

1.8 SUBMITTALS

A. Refer to Division 01 and General Conditions for submittal requirements in addition to requirements specified herein.

B. Refer to Division 01 for acceptance of electronic submittals. If not specified by Division 01, provide electronic submittals. If Division 01 requires paper submittals, provide the quantity of submittals required, but no fewer than seven (7) sets.

C. For electronic submittals, Contractor shall submit the documents in accordance with this Section and the procedures specified in Division 01. Contractor shall notify the Architect and Engineer that the submittals have been posted. If electronic submittal procedures are not defined in Division 01, Contractor shall include the website, username and password information needed to access the submittals. For submittals sent by e-mail, Contractor shall copy the Architect and Engineer's designated representatives. Contractor shall allow for the Engineer Review Time as specified. Contractor shall submit only the documents required to purchase the materials and/or equipment in the submittal.

D. Engineer Review Time: Transmit submittals as early as required to support the project schedule. Allow two weeks for Engineer review time plus to/from mailing time, plus a duplication of this time for resubmittal if required. Transmit submittals as soon as possible after Notice to Proceed and before Mechanical construction starts.

E. Submittals and shop drawings shall not contain the firm name, logo, seal, or signature of the Engineer. They shall not be copies of the work product of the Engineer. If the

Contractor desires to use elements of such product, the license agreement for transfer of information obtained from the Engineer must be used.

F. Assemble and submit for review manufacturer product literature for material and equipment to be furnished and/or installed under this Division. Literature shall include shop drawings, manufacturer product data, performance sheets, samples, and other submittals required by this Division as noted in each individual Section. General product catalog data not specifically noted to be part of the specified product will be rejected and returned without review.

G. Separate submittals according to individual specification sections. Only resubmit those sections requested for resubmittal.

H. Provide submittals in sufficient detail so as to demonstrate compliance with these Contract Documents and the design concept. Highlight, mark, list or indicate the materials, performance criteria and accessories that are being proposed. Illegible submittals will be rejected and returned without review.

I. Refer to individual Sections for additional submittal requirements.

J. Before transmitting submittals and material lists, verify that the equipment submitted is mutually compatible with and suitable for the intended use. Verify that the equipment will fit the available space and maintain manufacturer recommended service clearances. If the size of equipment furnished makes necessary any change in location, or configuration, submit a shop drawing showing the proposed layout.

K. Submittals shall contain the following information:

1. The project name.
2. The applicable specification section and paragraph.
3. Equipment identification acronym as used on the drawings.
4. The submittal date.
5. The Contractor's stamp, which shall certify that the stamped drawings have been checked by the Contractor, comply with the Drawings and Specifications, and have been coordinated with other trades.
6. Submittals not so identified will be returned to the Contractor without action.

L. The checking and subsequent acceptance by the Engineer and/or Contract Administrator of submittals shall not relieve responsibility from the Contractor for (1) deviations from Drawings and Specifications; (2) errors in dimensions, details, sizes of equipment, or quantities; (3) omissions of components or fittings; and (4) not coordinating items with actual building conditions and adjacent work. Contractor shall request and secure written acceptance from the Engineer and Architect prior to implementing any deviation.

1.9 SUBSTITUTIONS

A. Refer to Division 01 and General Conditions for substitutions in addition to requirements specified herein.

B. Materials, products, equipment, and systems described in the Bidding Documents establish a standard of required function, dimension, appearance and quality to be met by the proposed substitution.

C. The base bid shall include only the products from manufacturers specifically named in the drawings and specifications.

D. Request for Substitution:

1. Complete and send the Substitution Request Form attached at the end of this section for each material, product, equipment, or system that is proposed to be substituted.

2. The burden of proof of the merit of the proposed substitution is upon the proposer.

3. Unless stated otherwise in writing to the Engineer by the Contractor, Contractor warrants to the Engineer and Owner the following:

a. Proposed substitution has been fully investigated and determined to meet or exceed the specified Work in all respects.

b. Proposed substitution is consistent with the Contract Documents and will produce indicated results, including functional clearances, maintenance service, and sourcing of replacement parts.

c. Proposed substitution has received necessary approvals of the Authorities Having Jurisdiction.

d. Same warranty will be furnished for proposed substitution as for specified Work.

e. If accepted substitution fails to perform as required, Contractor shall replace substitute material or system with that originally specified and bear costs incurred thereby.

f. Coordination, installation and changes in the Work as necessary for accepted substitution will be complete in all respects.

E. Substitution Consideration:

1. No substitutions will be considered unless the Substitution Request Form is completed and attached with the appropriate substitution documentation.

2. Prior to receipt of Bids: No substitutions will be considered prior to receipt of bids unless written request for approval to bid has been received by the Engineer at least ten (10) calendar days prior to the date for receipt of bids.

a. If the proposed substitution is approved prior to receipt of bids, such approval will be stated in an addendum. Bidders shall not rely upon approvals made in any other manner. Verbal approval will not be given.

3. After receipt of Bids: No substitutions will be considered after receipt of Bids and before award of the Contract.

4. After award of Contract: No substitutions will be considered after the Contract is awarded unless specifically provided in the Contract Documents.

1.10 ELECTRONIC DRAWING FILES

A. In preparation of shop drawings or record drawings, Contractor may, at their option, obtain electronic drawing files in AutoCAD or DXF format from the Engineer for a shipping and handling fee of $200 for a drawing set up to 12 sheets and $15 per sheet for each additional sheet.

B. Contractor shall request and complete the Electronic File Release Agreement form from the Engineer. Send the form along with a check made payable to Henderson Engineers, Inc. Contractor shall indicate the desired shipping method and drawing format on the attached form.

C. The following must be received before electronic drawing files will be sent:

1. Engineer’s release agreement form
2. Payment

1.11 QUALITY ASSURANCE

A. Execute all work under this Division in a thorough and professional manner by competent and experienced workmen duly trained to perform the work specified.

B. Install all work in strict conformance with all manufacturers' requirements and recommendations, unless these Documents exceed those requirements. Install all equipment and materials in a neat and professional manner, aligned, leveled, and adjusted for satisfactory operation, in accordance with NECA guidelines.

C. Unless indicated otherwise on the Drawings, provide all material and equipment new, of the best quality and design, free from defects and imperfections and with markings or a nameplate identifying the manufacturer and providing sufficient reference to establish quality, size and capacity. Provide all material and equipment of the same type from the same manufacturer whenever practicable.

D. Unless specified otherwise, manufactured items of the same types specified within this Division shall have been installed and used, without modification, renovation, or repair for not less than one year prior to date of bidding for this Project.

1.12 OPERATION AND MAINTENANCE MANUALS

A. Refer to Division 01 and General Conditions for Operation and Maintenance Manuals in addition to requirements specified herein.

B. Submit manuals prior to requesting the final punch list and before all requests for Substantial Completion.

C. Instruct the Owner's permanent personnel in the proper operation of, startup and shutdown procedures and maintenance of the equipment and components of the systems installed under this Division.

D. Prior to Substantial Completion of the project, furnish the Operation and Maintenance Manuals to the Contract Administrator, for Engineer’s review, and for the Owner’s use.

1. Refer to Division 01 for acceptance of electronic manuals for this project. If not specified in Division 1, provide manuals in the form of a multiple file composite

electronic PDF file for each manual type required. Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size. Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

a. Contractor shall notify the Contract Administrator and Engineer that the manuals have been posted. If electronic manual procedures are not defined in Division 01, Contractor shall include the website, username and password information needed to access the manuals. For manuals sent by e-mail, Contractor shall copy the Contract Administrator's and Engineer's designated representatives.

2. If Division 01 requires paper manuals, provide four (4) copies of Operation and Maintenance Manuals in labeled, hard-back three-ring binders, with cover, binding label, tabbed dividers and plastic insert folders for Record Drawings.

E. Each manual shall contain equipment data, approved submittals, shop drawings, diagrams, capacities, spare part numbers, manufacturer service and maintenance data, warranties and guarantees. Include local contacts, complete with address and telephone number, for equipment, apparatus, and system components furnished and installed under this Division of the specifications.

1.13 SPARE PARTS

A. Provide to the Owner the spare parts specified in the individual sections of this Division

1.14 RECORD DRAWINGS

A. Refer to Division 01 and General Conditions for Record Drawings in addition to requirements specified herein.

B. A set of work prints of the Contract Documents shall be kept on the jobsite during construction for the purpose of noting changes. During the course of construction, the Contractor shall indicate on these Documents changes made from the original Contract Documents. Particular attention shall be paid to those items which need to be located for servicing. Underground utilities shall be located by dimension from column lines.

C. At the completion of the project, the Contractor shall obtain, at their expense, reproducible copies of the final drawings and incorporate changes noted on the jobsite work prints onto these drawings. These changes shall be done by a skilled drafter. Each sheet shall be marked "Record Drawing", along with the date. These drawings shall be delivered to the Contract Administrator.

1.15 DELIVERY, STORAGE AND HANDLING

A. Refer to Division 01 and General Conditions for Delivery, Storage and Handling in addition to requirements specified herein.

B. Deliver equipment and material to the job site in their original containers with labels intact, fully identified with manufacturer's name, make, model, model number, type, size, capacity and Underwriter's Laboratories, Inc. labels and other pertinent information necessary to identify the item.

C. Deliver, receive, handle and store equipment and materials at the job site in the designated area and in such a manner as to prevent equipment and materials from damage and loss. Store equipment and materials delivered to the site on pallets and cover with waterproof, tear resistant tarp or plastic or as required to keep equipment and materials dry. Follow manufacturer's recommendations, and at all times, take every precaution to properly protect equipment and material from damage, including the erection of temporary shelters to adequately protect equipment and material stored at the Site. Equipment and/or material which becomes rusted or damaged shall be replaced or restored by the Contractor to a condition acceptable to the Contract Administrator.

D. Be responsible for the safe storage of tools, material and equipment.

1.16 WARRANTIES

A. Refer to Division 01 and General Conditions for Warranties in addition to requirements specified herein.

B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

C. Warrant each system and each element thereof against all defects due to faulty workmanship, design or material for a period of 12 months from date of Substantial Completion, unless specific items are noted to carry a longer warranty in these Construction Documents or manufacturer’s standard warranty exceeds 12 months. Remedy all defects, occurring within the warranty period(s), as stated in the General Conditions and Division 01.

D. Also warrant the following additional items:

1. All raceways are free from obstructions, holes, crushing, or breaks of any nature.
2. All raceway seals are effective.
3. The entire electrical system is free from all short circuits and unwanted open circuits and grounds.

E. The above warranties shall include labor and material. Make repairs or replacements without any additional costs to the Owner.

F. Perform the remedial work promptly, upon written notice from the Contract Administrator or Owner.

G. At the time of Substantial Completion, deliver to the Owner all warranties, in writing and properly executed, including term limits for warranties extending beyond the one year period, each warranty instrument being addressed to the Owner and stating the commencement date and term.

1.17 TEMPORARY FACILITIES

A. Refer to Division 01 and General Conditions for Temporary Facilities requirements in addition to requirements specified herein.

B. Temporary Utilities: The types of services required include, but are not limited to, electricity, telephone, and internet. When connecting to existing franchised utilities for required services, comply with service companies' recommendations on materials and methods, or engage service companies to install services. Locate and relocate services (as necessary) to minimize interference with construction operations.

C. Construction Facilities: Provide facilities reasonably required to perform construction operations properly and adequately.

1. Enclosures: When temporary enclosures are required to ensure adequate workmanship, weather protection and ambient conditions required for the work, provide fire-retardant treated lumber and plywood; provide tarpaulins with UL label and flame spread of 15 or less; provide translucent type (nylon reinforced polyethylene) where daylighting of enclosed space would be beneficial for workmanship, and reduce use of temporary lighting.

2. Heating: Provide heat, as necessary, to protect work, materials and equipment from damage due to dampness and cold. In areas where building is occupied, maintain a temperature not less than 65 degrees F. Use steam, hot water, or gas from piped distribution system where available. Where steam, hot water or piped gas are not available, heat with self-contained LP gas or fuel oil heaters, bearing UL, FM or other approval labels appropriate for application. Use electric-resistance space heaters only where no other, more energy-efficient, type of heater is available and allowable.

a. Vent and exhaust fuel-burning heaters per SMACNA Guidelines for Source Control and equip units with individual-space thermostatic controls.

b. If permanent HVAC systems are used during construction, provide HVAC Protection and replace all filtration prior to occupancy in accordance with SMACNA Guidelines.

1.18 FIELD CONDITIONS

A. Conditions Affecting Work In Existing Buildings: The following project conditions apply:

1. The Drawings describe the general nature of remodeling to the existing building; however, visit the site prior to submitting bid to determine the nature and extent of work involved.

2. Schedule work in the existing building with the Owner.

3. Perform certain demolition work prior to the remodeling. Perform the demolition that involves electrical systems, Light fixtures, equipment, raceways, equipment supports or foundations and materials.

4. Remove articles that are not required for the new work. Unless otherwise indicated, remove each item removed during this demolition from the premises and dispose in accordance with applicable federal, state and local regulations.

5. Relocate and reconnect electrical facilities that must be relocated in order to accomplish the remodeling shown in the Drawings or indicated in the

Specifications. Where electrical equipment or materials are removed, cap unused raceways below the floor line or behind the wall line to facilitate restoration of finish.

6. Finish material will be installed under other divisions.

7. Obtain permission from the Contract Administrator for roof penetrations and channeling of floors or walls not specifically noted on the Drawings.

8. Protect adjacent materials indicated to remain. For work specific to this Division, install and maintain dust and noise barriers to keep dirt, dust, and noise from being transmitted to adjacent areas. Remove protection and barriers after demolition operations are complete.

9. Locate, identify, and protect electrical services passing through demolition area and serving other areas outside the demolition limits. Maintain services to areas outside demolition limits. When services must be interrupted, provide temporary services for affected areas.

B. Conditions Affecting Excavations: The following project conditions apply:

1. Maintain and protect existing building services that transit the area affected by selective demolition.

2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by excavation operations.

C. Use of explosives is not permitted.

D. Environmental Conditions: Apply joint sealers under temperature and humidity conditions within the limits specified by the joint sealer manufacturer. Do not apply joint sealers to wet substrates.

PART 2 - PRODUCTS AND MATERIALS

2.1 SOIL MATERIALS

A. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, crushed slag, or natural or crushed sand.

B. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, with 100 percent passing a 1-1/2-inch sieve, and not more than 5 percent passing a No. 4 sieve.

C. Backfill and Fill Materials: Materials complying with ASTM D2487 soil classification groups GW, GP, GM, SM, SW, and SP; free of clay, rock, or gravel larger than two inches in any dimension; debris; waste; frozen materials; and vegetable and other deleterious matter.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install in accordance with manufacturer’s instructions.

3.2 EXISTING CONDITIONS

A. Existing conditions indicated on the Drawings are taken from the best information available from the Owner, existing record drawings, and from limited, in-situ, visual site observations; and they are not to be construed as "AS BUILT" conditions. The information is shown to help establish the extent of the new work.

B. Verify all actual existing conditions at the project site and perform the Work as required to meet the existing conditions and the intent of the Work indicated.

C. Notify Contract Administrator immediately of any dangerous conditions that exist on the job site, as they are discovered, before demolition, during selective demolition or before remodel work begins.

3.3 EXISTING UTILITIES

A. Prepare and submit a schedule of anticipated utility outages indicating dates and duration. Schedule

B. Schedule and coordinate with the utility companies, Owner and with the Contract Administrator all connections to, relocation of, or discontinuation of normal utility services from any existing utility line. Include all premium time required for all such work in the bid.

C. Repair all existing utilities damaged due to construction operations to the satisfaction of the Owner or utility companies without additional cost.

D. Do not leave utilities disconnected at the end of a workday or over a weekend unless authorized by representatives of the Owner or Contract Administrator.

E. Make repairs and restoration of utilities before workers leave the project at the end of the workday in which the interruption takes place.

F. Include in bid the cost of furnishing temporary facilities to provide all services during interruption of normal utility service.

3.4 WORK IN EXISTING FACILITIES

A. The Drawings describe the general nature of remodeling to the existing facilities; however, visit the site prior to submitting a bid, to determine the nature and extent of work involved.

B. Schedule work in the existing facility with the Owner.

C. Certain demolition work shall be performed prior to the remodeling. Perform the demolition that involves electrical systems, fixtures, conduit, wiring, equipment, equipment supports or foundations and materials.

D. Remove all of these articles that are not required for the new work. Unless otherwise indicated, each item removed during this demolition shall be removed from the premises and disposed of in accordance with all state and local regulations.

E. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner, or others, unless permitted under the following conditions and then

only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Contract Administrator and the Owner no fewer than 7 days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Contract Administrator and the Owner's written permission.
3. Owner reserves the right to require Contractor to cease work in any area Owner requires access to on an emergency basis.
4. Make every effort to schedule outages during non-business or off-peak business hours to minimize disruptions to business operations.

F. Relocate and reconnect all electrical facilities that must be relocated in order to accomplish the remodeling shown in the Drawings or indicated in the Specifications. Where electrical fixtures or equipment are removed, cap all unused raceways behind the floor line or wall line to facilitate restoration of finish, and, remove all existing wiring from abandoned raceways.

G. Finish materials are specified in other divisions.

H. Where removal of existing wiring interrupts electrical continuity of circuits that are to remain in use, provide necessary wiring, raceways, junction boxes, etc., to ensure continued electrical continuity.

I. Penetrate roofs, channel walls and floors as required to produce the desired result; however, obtain permission from the Contract Administrator for all penetrations and channeling not specifically noted on the Drawings.

J. Provide new, typewritten card directory for distribution equipment (including but not limited to load centers, panelboards, switchboards and switchgear) where changes occur under this scope of work. Indicate exact loads served by each existing circuit breaker or switch. Where circuit designations are not specifically indicated on the Drawings, provide a unique identifier for each updated circuit within the directory.

K. Coordinate work with phasing drawings to properly stage transitions of work to provide power to existing, new and temporary loads. Monitor loads on distribution system to ensure shifting of loads does not overload electrical equipment.

L. Work in common areas must be reviewed and approved by the Contract Administrator and Owner prior to commencement of the work.

1. Contractor shall minimize any disruption and disturbances to areas outside zones scheduled for work. All work within other areas must be coordinated with and approved by the Owner.

3.5 PERMITS

A. Secure and pay for all permits required in connection with the installation of the Electrical Work. Arrange with the various utility companies for the installation and connection of all required utilities for this facility and pay all charges associated therewith including connection charges and inspection fees, except where these services or fees are designated to be provided by others.

3.6 TEMPORARY ELECTRICAL SERVICE AND WIRING

A. Provide 208Y/120 volt, three-phase, four-wire, temporary electrical service and temporary lighting system to facilitate construction.

B. In existing facilities, with Owner's approval, Contractor may utilize the existing electrical system as the source of temporary power. Coordinate the point of connection and method of connection to the existing system with the Owner's Representative.

C. Pay all charges made by the Electric Utility, with respect to installation and energy charges for temporary services.

D. Work for the temporary power shall consist of all labor and materials, including, but not limited to conduit, wiring, panelboards, fuse blocks, fused disconnecting switches, fuses, pigtails, receptacles, wood panel switch supports, and other miscellaneous materials required to complete the power system.

E. Install all temporary wiring in accordance with applicable codes, and maintain in an OSHA-approved manner.

F. Provide an adequate number of GFCI type power distribution centers, rated 208Y/120V, four-wire, and not less than 60A, with sufficient fuse blocks or breakers for lighting and hand tool circuits, 60A four-wire feeders, all mounted within pre-fabricated enclosures UL listed for this application or on suitable wood panels bolted to columns or upright wood supports as required.

G. Install circuits to points on each level of each building so that service outlets can be reached by a 50-foot extension cord for 120V power and a 100-foot extension cord for 208V power (or as required by OSHA or local authorities).

H. Provide one lighting outlet per 30 linear feet of corridor and at least one light in each room and for every 800 square feet of floor area. Temporary lighting shall comply with OSHA requirements.

I. If additional service is required for cranes, electrical welders or for electric motors over 1/2 HP per unit, such additional service shall become the responsibility of the trade involved.

J. When the permanent wiring for lighting and power is installed, with approval of the Contract Administrator and Owner, the permanent system may be used, provided the Contractor assumes full responsibility for all electrical material, equipment, and devices contained in the systems and provided that roof drainage system and roofing are complete.

K. When directed by the Contract Administrator, remove all temporary services, lighting, wiring and devices from the property.

3.7 SELECTIVE DEMOLITION

A. Refer to Division 01, Division 02, and General Conditions for Selective Demolition requirements in addition to the requirements specified herein.

B. General: Demolish, remove, demount, and disconnect abandoned electrical materials and equipment indicated to be removed and not indicated to be salvaged or saved.

C. Materials and Equipment To Be Salvaged: remove, demount, disconnect existing electrical materials and equipment indicated to be removed and salvaged, and deliver materials and equipment to the location designated for storage.

D. Disposal and Cleanup: Remove from the site and legally dispose of demolished materials and equipment not indicated to be salvaged.

E. Electrical Materials and Equipment: Demolish, remove, demount, and disconnect the following items:

1. Inactive and obsolete raceways, fittings, supports and specialties, equipment, wiring, controls, fixtures, and insulation:

a. Raceways and outlets embedded in floors, walls, and ceilings may remain if such materials do not interfere with new installations. Cut embedded raceways to below finished surfaces, seal, and refinish surfaces as specified or as indicated on the Architectural Finish Drawings. Remove materials above accessible ceilings. Cap raceways allowed to remain.

b. Perform cutting and patching required for demolition in accordance with Division 01, General Conditions and "Cutting and Patching" portion of this Section in Division 26.

3.8 ACCESS TO EQUIPMENT

A. Locate all pull boxes, junction boxes and controls to provide easy access for operation, service inspection and maintenance. Provide an access door where equipment or devices are located above inaccessible ceilings. Refer to Division 26 Section “Common Work Results for Electrical”.

B. Maintain all code required clearances and clearances required by manufacturers.

3.9 PENETRATIONS

A. Unless otherwise noted as being provided under other divisions, provide sleeves, box frames, or both, for openings in floors, walls, partitions and ceilings for all electrical work that passes through construction. Refer to Division 26 Section “Common Work Results for Electrical”.

B. Provide sleeves, box frames, or both, for all conduit, cable, and busways that pass through masonry, concrete or block walls.

C. The cutting of new and/or existing construction will not be permitted except by written approval of the Contract Administrator.

3.10 EXCAVATION AND BACKFILLING

A. Refer to Division 01, Division 02 and General Conditions for Excavation and Backfilling in addition to the requirements specified herein.

B. Perform excavation of every description, of whatever substance encountered and to the depth required in connection with the installation of the work under this division. Excavation shall be in conformance with applicable Divisions and sections of the Specifications.

C. Restore roads, alleys, streets and sidewalks damaged during this work to the satisfaction of Authorities Having Jurisdiction.

D. Do not excavate trenches close to walks or columns without prior consultation with the Contract Administrator.

E. Erect barricades around excavations, for safety, and place an adequate number of amber lights on or near the work and keep those burning from dusk to dawn. Be responsible for all damage that any parties may sustain in consequence of neglecting the necessary precautions in prosecuting the work.

F. Slope sides of excavations to comply with local, state, and federal codes and ordinances. Shore and brace as required for stability of excavation.

G. Shoring and Bracing: Establish requirements for trench shoring and bracing to comply with local, state, and federal codes and authorities. Maintain shoring and bracing in excavations regardless of time period excavations will be open.

1. Remove shoring and bracing when no longer required. Where sheeting is allowed to remain, cut top of sheeting at an elevation of 30 inches below finished grade elevation.

H. Install sediment and erosion control measures in accordance with local codes and ordinances.

I. Dewatering: Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.

1. Do not allow water to accumulate in excavations. Remove water to prevent softening of bearing materials. Provide and maintain dewatering system components necessary to convey water away from excavations.

2. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey surface water to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches. In no case shall sewers be used as drains for such water.

J. Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage.

1. Locate and retain soil materials away from edge of excavations. Do not store within dripline of trees indicated to remain.

2. Remove and legally dispose of excess excavated materials and materials not acceptable for use as backfill or fill.

K. Excavation for Underground Structures: Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot; plus a sufficient distance to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.

1. Excavate, by hand, areas within dripline of large trees. Protect the root system from damage and dry-out. Maintain moist conditions for root system and cover exposed roots with burlap. Paint root cuts of one inch in diameter and larger with emulsified asphalt tree paint.

2. Take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed.

L. Trenching: Excavate trenches for electrical installations as follows:

1. Excavate trenches to the uniform width, sufficiently wide to provide ample working room and a minimum of six to nine inches clearance on both sides of raceway and cables.

2. Excavate trenches to depth indicated or required for raceway and cables to establish slope, away from buildings and indicated elevations. Beyond building perimeter, excavate trenches to an elevation below frost line.

3. Limit the length of open trench to that in which raceway and cables can be installed, tested, and the trench backfilled within the same day.

4. Where rock is encountered, carry excavation below required elevation and backfill with a layer of crushed stone or gravel prior to installation of raceway and cables. Provide a minimum of six inches of stone or gravel cushion between rock bearing surface and raceway and cables.

5. Excavate trenches for raceway, cables, and equipment with bottoms of trench to accurate elevations for support of raceway and cables on undisturbed soil.

M. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.

N. Backfilling and Filling: Place soil materials in layers to required subgrade elevations for each area classification listed below, using materials specified in Part 2 of this Section.

1. Under walks and pavements, use a combination of subbase materials and excavated or borrowed materials.

2. Under building slabs, use drainage fill materials.

3. Under raceway and cables, use subbase materials where required over rock bearing surface and for correction of unauthorized excavation.

4. For raceway and cables less than 30 inches below surface of roadways, provide 4-inch-thick concrete base slab support. After installation and testing of raceway and cables, provide a 4-inch thick concrete encasement (sides and top) prior to backfilling and placement of roadway subbase.

5. Other areas use excavated or borrowed materials.

O. Backfill excavations as promptly as work permits, but not until completion of the following:

1. Inspection, testing, approval, and locations of underground utilities have been recorded.

2. Removal of concrete formwork.

3. Removal of shoring and bracing, and backfilling of voids.

4. Removal of trash and debris.

P. Placement and Compaction: Place backfill and fill materials in layers of not more than 8 inches in loose depth for material compacted by heavy equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

1. For vertical and diagonal raceway installations, thoroughly support raceways from permanent structures or undisturbed earth at no less that 10-foot intervals, while placing backfill materials, so that raceways are not deflected, crushed, broken, or otherwise damaged by the backfill placement.

Q. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification specified below. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

R. Place backfill and fill materials evenly adjacent to structures, piping, and equipment to required elevations. Prevent displacement of raceways and equipment by carrying material uniformly around them to approximately same elevation in each lift.

S. Compaction: Control soil compaction during construction, providing minimum percentage of density specified for each area classification indicated below:

1. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density for soils which exhibit a well-defined moisture-density relationship (cohesive soils), determined in accordance with ASTM D 1557 and not less than the following percentages of relative density, determined in accordance with ASTM D 2049, for soils which will not exhibit a well-defined moisture-density relationship (cohesionless soils).

a. Areas Under Structures, Building Slabs and Steps, Pavements: Compact top 12 inches of subgrade and each layer of backfill or fill material to 90 percent maximum density for cohesive material, or 95 percent relative density for cohesionless material.

b. Areas Under Walkways: Compact top 6 inches of subgrade and each layer of backfill or fill material to 90 percent maximum density for cohesive material, or 95 percent relative density for cohesionless material.

c. Other Areas: Compact top 6 inches of subgrade and each layer of backfill or fill material to 85 percent maximum density for cohesive soils, and 90 percent relative density for cohesionless soils.

2. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water. Apply water in minimum quantity necessary to achieve required moisture content and to prevent water appearing on surface during, or subsequent to, compaction operations.

T. Subsidence: Where subsidence occurs at mechanical installation excavations during the period 12 months after Substantial Completion, remove surface treatment (i.e., pavement, lawn, or other finish), add backfill material, compact to specified conditions, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent areas.

3.11 CUTTING AND PATCHING

A. Cut walls, floors, ceilings, and other portions of the facility as required to install work under this Division.

B. Obtain permission from the Engineer prior to cutting. Do not cut or disturb structural members without prior approval from the Architect and Structural Engineer.

C. For post-tension slabs, x-ray slab and closely coordinate all core drill locations with Architect and Structural Engineer prior to performing any work. Obtain approval from Architect and Structural Engineer for all core drills and penetrations at least four days prior to performing work.

D. Penetrations shall be made as small as possible while maintaining required clearances between the building element penetrated and the system component.

E. Patch around openings to match adjacent construction, including fire ratings, if applicable.

F. Repair and refinish areas disturbed by work to the condition of adjoining surfaces in a manner satisfactory to the Architect.

3.12 PAINTING

A. Refer to Division 09 Section "Painting" for painting requirements.

B. Paint exposed ferrous surfaces, including, but not limited to, hangers, equipment stands and supports using materials and methods as specified under individual sections and Division 09 of the Specifications; colors shall be as selected by the Contract Administrator.

C. Re-finish all field-threaded ends of galvanized conduits and field-cut ends of galvanized supports with a cold-galvanizing compound approved for use on conductive surfaces. Follow closely manufacturer's instructions for pre-cleaning surfaces and application.

D. Factory finishes and shop priming and special finishes are specified in the individual equipment Specification sections.

E. Where factory finishes are provided and no additional field painting is specified, touch up or refinish, as required by, and to the acceptance of, the Contract Administrator, marred or damaged surfaces so as to leave a smooth, uniform finish. If, in the opinion of the Contract Administrator, the finish is too badly damaged to be properly re-finished, replace the damaged equipment or materials at no additional costs to the Owner.

3.13 CLEANING

A. Remove dirt and refuse, resulting from the performance of the Work, from the premises as required to prevent accumulation. Cooperate in maintaining reasonably clean premises at all times.

B. Immediately prior to the final inspection, the Electrical Contractor shall clean material and equipment installed under the Electrical Contract. Dirt, dust, plaster, stains, and foreign matter shall be removed from surfaces including components internal to equipment.

C. Damaged finishes shall be touched-up and restored to their original condition

3.14 ADJUSTING, ALIGNING AND TESTING

A. Adjust, align and test all electrical equipment furnished and/or installed under this Division.

B. Check motors for alignment with drive and proper rotation, and adjust as required.

C. Check and test protective devices for specified and required application, and adjust as required.

D. Check, test and adjust adjustable parts of all light fixtures and electrical equipment as required to produce the intended performance.

E. Verify that completed wiring system is free from short circuits, unintentional grounds, low insulation impedances, and unintentional open circuits.

F. After completion, perform tests for continuity, unwanted grounds, and insulation resistance in accordance with the requirements of NFPA 70 and NETA.

G. Be responsible for the operation, service and maintenance of all new electrical equipment during construction and prior to acceptance by the Owner of the complete project under this Contract. Maintain all electrical equipment in the best operating condition including proper lubrication.

H. Notify the Contract Administrator immediately of all operational failures caused by defective material, labor or both.

I. Maintain service and equipment for all testing of electrical equipment and systems until all work is approved and accepted by the Owner.

J. Keep a calibrated voltmeter and ammeter (true RMS type) available at all times. Provide service for test readings when and as required.

K. Refer to individual sections for additional and specific requirements.

3.15 START-UP OF SYSTEMS

A. Prior to start-up of electrical systems, check all components and devices, lubricate items appropriately, and tighten all screwed and bolted connections to manufacturers' recommended torque values using appropriate torque tools.

B. Each power, lighting and control circuit shall be energized, tested and proved free of breaks, short-circuits and unwanted grounds.

C. Adjust taps on each transformer for rated secondary voltages.

D. Balance all single phase loads at each panelboard, redistributing branch circuit connections until balance is achieved to plus or minus 10 percent.

E. Replace all burned-out lamps. Replace the lamps of all light fixtures that use incandescent, halogen or quartz lamp sources that are installed as part of the finished building, but are used by the Contractor during construction, with new lamps of appropriate type and wattage prior to turning the facility over to the Owner.

F. After all systems have been inspected and adjusted, confirm all operating features required by the Drawings and Specifications and make final adjustments as necessary.

G. Demonstrate that all equipment and systems perform properly as designed per Drawings and Specifications.

H. At the time of final review and tests of the power and lighting systems, all equipment and system components shall be in place and all connections at panelboards, switches, circuit breakers, and the like, shall be complete. All fuses shall be in place, and all circuits shall be continuous from point of service connections to all switches, receptacles, outlets, and the like.

3.16 TEST REPORTS

A. Perform tests as required by these Specifications and submit the results to the Contract Administrator, for Engineer's review. Record the results, date and time of each test and the conditions under which the test was conducted. Include a copy of the finalized test results, with corrections made, in the operations and maintenance manuals. The tests shall establish the adequacy, quality, safety, and reliability for each electrical system installed. Notify the Contract Administrator and Engineer two working days prior to each test.

B. For specific testing requirements of special systems, refer to the Specification section that describes that system. The Contractor shall provide the following to facilitate the testing of the electrical systems:

1. Perform tests as described in the individual sections;

C. Upon completing each test, record the results, date and time of each test and the conditions under which the test was conducted. Submit to the Contract Administrator, for Engineer's review, in duplicate, the test results for the following electrical items:

1. Building service entrance voltage and amperes at each phase.
2. Electrical service grounding conditions and grounding resistance.
3. Proper phasing throughout the entire system.
4. Voltages (phase-to-phase and phase-to-neutral) and amperes at each phase for each panelboard, switchboard, and the like.
5. Phase voltages and amperes at each three-phase motor.
6. Test all wiring devices for electrical continuity and proper polarity of connections.

D. Promptly correct all failures or deficiencies revealed by these tests in accordance with the manufacturer's recommendations and as determined by the Engineer.

3.17 SUBSTANTIAL COMPLETION REVIEW

A. Prior to requesting a site observation for "CERTIFICATION OF SUBSTANTIAL COMPLETION", complete the following items:

1. Submit complete Operation and Maintenance Data.
2. Submit complete Record Drawings.
3. Perform all required training of Owner's personnel.
4. Turn over video recordings of training sessions to the Owner.
5. Turn over all spares and extra materials to the Owner, along with a complete inventory of spares and extra materials being turned over.
6. Perform start-up tests of all systems.
7. Remove all temporary facilities from the site.

8. Comply with all requirements for Substantial Completion in the Division 01 and General Conditions.

B. Request in writing a review for Substantial Completion. Give the Contract Administrator at least seven (7) days' notice prior to the review.

C. State in the written request that the Contractor has complied with the requirements for Substantial Completion.

D. Upon receipt of a request for review, the Contract Administrator will either proceed with the review or advise the Contractor of unfilled requirements.

E. If the Contractor requests a site visit for Substantial Completion review prior to completing the above-mentioned items the Contractor shall reimburse the Contract Administrator and Engineer for time and expenses incurred for the visit.

F. Upon completion of the review, the Contract Administrator will prepare a "final list" of outstanding items to be completed or corrected for final acceptance.

G. Omissions on the "final list" shall not relieve the Contractor from the requirements of the Contract Documents.

H. Prior to requesting a final review, submit a copy of the final list of items to be completed or corrected. State in writing that each item has been completed, resolved for acceptance or the reason it has not been completed.

END OF SECTION 260010

SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This Section includes limited scope general construction materials and methods, electrical equipment coordination, and common electrical installation requirements as follows:

1. Access doors in walls, ceilings, and floors for access to electrical materials and equipment.
2. Sleeves and seals for electrical penetrations.
3. Joint sealers for sealing around electrical materials and equipment, and for sealing penetrations in fire and smoke barriers, floors, and foundation walls.
4. Sealing penetrations through noise critical spaces.

1.2 DEFINITIONS

A. The following abbreviations apply to this and other Sections of these Specifications:

1. AHJ: Authority(ies) having Jurisdiction
2. ATS: Acceptance Testing Specifications
3. EPDM: Ethylene-propylene-diene monomer rubber
4. MC: Metal Clad
5. N/A: Not Available or Not Applicable
6. NBR: Acrylonitrile-butadiene rubber
7. NRTL: Nationally Recognized Testing Laboratory
8. PCF: Pounds per Cubic Foot

B. The following definitions apply to this and other Sections of these Specifications:

1. Homerun: That portion of an electrical circuit originating at a junction box, termination box, receptacle or switch with termination at an electrical panelboard. Note: Where MC Cable is utilized for receptacle and/or lighting branch circuiting loads, the originating point of the homerun shall be at the first load in the circuit or at a junction box in an accessible ceiling space immediately above the first load.

1.3 ADMINISTRATIVE REQUIREMENTS

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

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping, ducts, and other systems installed at required slopes and/or elevations.

4. So connecting raceways, cables, and wireways will be clear of obstructions and of the working and access space of other equipment.

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

C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed.

D. Coordinate electrical testing of electrical, mechanical, and architectural items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Division 01 and Division 26 Section "General Electrical Requirements":

1. Product data for the following products:
   a. Sleeve seals.
   b. Through and membrane penetration firestopping systems.
   c. Joint sealers
2. Shop drawings for:
   a. Detailed fabrication drawings of access panels and doors.
3. Through and Membrane Penetration Firestopping Systems Product Schedule: Provide UL listing, location, wall or floor rating and installation drawing for each penetration fire stop system.
   a. Where Project conditions require modification to qualified testing and inspecting agency's illustrations for a particular firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.
   b. Qualifications data for testing agency.
4. Record Drawings: Submit Record Drawings as required by Division 01 and Division 26
   a. Accurately record actual locations of firestopped penetrations and access panel/door locations. Indicate dimensions from fixed structural elements.

PART 2 - PRODUCTS AND MATERIALS

2.1 ACCESS TO EQUIPMENT

A. Manufacturers:

1. Bar-Co., Inc.
2. Elmdor Stoneman.
3. JL Industries

4. Jay R. Smith Mfg. Co.
5. Karp Associates, Inc.
6. Milcor
7. Nystrom Building Products
8. Wade
9. Zurn

B. Access Doors:

1. Provide access doors for all concealed equipment, except where above lay-in ceilings. Refer to Section “Identification for Electrical Systems” for labeling of access doors.
2. Access doors shall be adequately sized for the devices served with a minimum size of 18 inches x 18 inches, furnished by the respective Contractor or Subcontractor and installed by the General Contractor.
3. Access doors must be of the proper construction for type of construction where installed.
4. The exact location of all access doors shall be verified with the Contract Administrator and owner prior to installation.
5. Steel Access Doors and Frames: Factory-fabricated and assembled units, complete with attachment devices and fasteners ready for installation. Joints and seams shall be continuously welded steel, with welds ground smooth and flush with adjacent surfaces.
6. Frames: 16-gauge steel, with a 1-inch-wide exposed perimeter flange for units installed in unit masonry, pre-cast, or cast-in-place concrete, ceramic tile, or wood paneling.
    a. For installation in masonry, concrete, ceramic tile, or wood paneling: 1-inch-wide exposed perimeter flange and adjustable metal masonry anchors.
    b. For installation in gypsum wallboard or plaster: perforated flanges with wallboard bead.
    c. For installation in full-bed plaster applications: galvanized, expanded metal lath and exposed casing bead, welded to perimeter of frame.
7. Flush Panel Doors: 14-gauge sheet steel, with concealed spring hinges or concealed continuous piano hinge set to open 175 degrees; factory-applied prime paint.
8. Locking Devices:
    a. In locations accessible to occupants, provide 5-pin or 5-disc type cylinder locks, all access panels keyed alike; provide 2 keys per access panel. Coordinate keying requirements with owner.

2.2 SLEEVES

A. Steel sleeves for raceways and cables:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends and drip rings.

B. Cast iron wall pipe sleeves for raceways and cables:

1. Manufacturers

a. Josam Mfg. Co.

b. Smith (Jay R) Mfg. Co.

c. Tyler Pipe/Wade Div.; Subs of Tyler Corp.

d. Watts Industries, Inc.

e. Zurn Industries, Inc.; Hydromechanics Div.

2. Cast-iron sleeve with integral clamping flange with clamping ring, and nuts for membrane flashing.

a. Underdeck Clamp: Clamping ring with setscrews.

3. Sleeves for rectangular openings: Galvanized sheet steel with minimum 0.052- or 0.138- inch thickness as indicated and of length to suit application.

4. Coordinate sleeve selection and application with selection and application of firestopping to be used.

2.3 SEALANTS

A. SLEEVE SEALS

1. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

2. Manufacturers:

a. Advance Products & Systems, Inc.

b. Calpico, Inc.

c. Metraflex Co.

d. O-Z/Gedney

e. Pipeline Seal and Insulator, Inc.

3. Sealing Elements: Interlocking or solid sealing links shaped or pre-drilled to fit surface of cable or raceway. Include type and number required for material and size of raceway or cable.

a. Neoprene

4. Pressure Plates: Include two for each sealing element. For multi-phase circuits, use slotted pressure plates if metal.

a. Stainless steel

5. Connecting Bolts and Nuts: Provide bolts of length required to secure pressure plates to sealing elements. Include one for each sealing element.

   a. Stainless steel

B. JOINT SEALERS

1. General: Joint sealers, joint fillers, and other related materials compatible with each other and with joint substrates under conditions of service and application.

2. Colors: As selected by the Contract Administrator from manufacturer's standard colors.

3. Elastomeric Joint Sealers: Provide the following types:

   a. Silicone Joint Sealants, One-part nonacid-curing, silicone sealant complying with ASTM C 920, Type S, Grade NS, Class 25, for uses in non-traffic areas for masonry, glass, aluminum, and other substrates recommended by the sealant manufacturer. Provide one of the following:

      1) Dow Corning, Dowsil 790

      2) Dow Corning, Dowsil 795

      3) GE, Silglaze II SCS 2350

      4) GE, Silpruf SCS 2000

      5) Owens Corning, Energy Complete

      6) Pecora, 864 NST

      7) Tremco, Spectrem 1

      8) Tremco, Spectrem 2

   b. Mildew Resistant Sealants, one-part mildew-resistant, silicone sealant complying with ASTM C 920, Type S, Grade NS, Class 25, for uses in non-traffic areas for glass, aluminum, metal or porcelain plumbing fixtures and nonporous joint substrates; formulated with fungicide; intended for sealing interior joints with nonporous substrates; and subject to in-service exposure to conditions of high humidity and temperature extremes. Provide one of the following:

      1) Dow Corning, Dowsil 786

      2) GE, Momentum SCS 1700

      3) Pecora, 898 Silicone NST

   c. Hybrid Joint Sealants: One-part, nonsag, paintable complying with ASTM C 920, Type S, Grade NS, Class 50 recommended for exposed applications on interior and exterior locations involving joint movement of not more than plus or minus 50 percent. Subject to compliance with requirements, provide one of the following:

      1) BASF, MasterSeal NP 100

      2) Pecora, DyanTrol I-XL

      3) Tremco, Dymonic FC

C. FIRESTOPPING

1. Sealants and accessories shall have fire-resistance ratings indicated, as established by testing identical assemblies in accordance with UL 2079 or ASTM E 814, by Underwriters' Laboratories, Inc., or other NRTL acceptable to AHJ. Subject to compliance with requirements, provide one of the following:

a. Manufacturers:

1) 3M Corp., Fire Barrier Sealant

2) Hilti, Inc.

3) Tremco, Tremstop Fyre-Sil

4) Pecora, AC-20 FTR

5) RectorSeal

6) Specified Technologies Inc. Firestop

7) USG, SHEETROCK Firecode Compound

8) Owens Corning Firestopping Insulation

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Install in accordance with manufacturer’s instructions.

B. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping”.

C. Coordinate seals with wall, ceiling, roof or floor materials and rating of the surface (sound, fire, waterproofing, etc.)

D. Comply with NECA 1.

E. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items, unless indicated otherwise.

F. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

G. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

H. Right of Way: Yield to raceways and piping systems installed at a required slope.

3.2 ACCESS DOORS

A. Verify the exact location, sizes, and types of all access doors with the Contract Administrator prior to purchase.

B. Provide access doors for all concealed electrical equipment, except where above lay-in ceilings.

C. Coordinate with architectural finishes to set frames accurately in position and securely attached to supports, with face panels plumb and level in relation to adjacent finish surfaces.

D. Adjust hardware and panels after installation for proper operation.

E. Label all access doors with a nameplate as described in Division 26 Section "Identification for Electrical Systems".

3.3 SLEEVES AND SLEEVE SEALS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Provide sleeves for required openings in all concrete and masonry construction and fire, smoke, or both, partitions, for all electrical work that passes through such construction. Coordinate with all other trades and divisions to dimension and lay out all such openings.

C. Only those openings specifically indicated on the Architectural or Structural Drawings will be provided under other divisions.

D. Construction in Existing Facilities:

1. Saw cut or core drill existing walls, roofs and slabs to install sleeves and sleeve seals in existing facilities. Do not cut or drill any walls, roofs or slabs without first coordinating with, and receiving approval from, the Contract Administrator, Owner, or both. Seal sleeves into concrete walls or slabs with a waterproof non-shrink grout acceptable to the Contract Administrator. Provide roofing penetration seals and covers to match existing roofing materials. Coordinate roofing repair of adjacent roofing material with Owner's roofing contractor to provide a waterproof installation.

E. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls. Do not cut or core drill new construction without written approval from the Contract Administrator and Structural Engineer.

F. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

G. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.

2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.

H. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

I. Install pipe and rectangular sleeves in above-grade walls and slabs, where penetrations are not subject to hydrostatic water pressures. Ensure that drip ring is fully encased and sealed within the wall or slab.

J. Sleeve Length:

1. Sleeves through walls: Cut sleeves to length for mounting flush with both surfaces of walls.

2. Sleeves through floors: Extend sleeves 2 inches above finished floor level.

K. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or as required to meet seismic criteria; in which case, size sleeves as recommended by the seal manufacturer or per seismic criteria, or both.

L. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

M. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint

N. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials.

O. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

P. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (or larger, if required by the seal manufacturer) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

Q. Above Grade Concrete or Masonry Penetrations

1. Provide sleeves for cables or raceways passing through above grade concrete or masonry walls, concrete floor or roof slabs. Sleeves are not required for core drilled holes in existing masonry walls, concrete floors or roofs. Provide sleeves as follows:

a. Install schedule 40 galvanized steel pipe for sleeves smaller than 6 inches in diameter.

b. Install galvanized sheet metal for sleeves 6 inches in diameter and larger, thickness shall be 0.138 inches.

c. Install galvanized sheet metal for rectangular sleeves

d. Schedule 40 PVC pipe sleeves are acceptable for use in areas without return air plenums.

2. Seal elevated floor, exterior wall and roof penetrations watertight and weather tight with non-shrink, non-hardening commercial sealant. Pack with mineral wool and seal both ends with minimum of ½" of sealant.

R. Underground, Exterior-Wall Penetrations: Install cast-iron wall pipes for sleeves. Size sleeves to allow for 1-inch (or larger, if required by the mechanical sleeve manufacturer) annular clear space between sleeve and cable or raceway. Provide mechanical sleeve seal.

1. Use type and number of sealing elements recommended by manufacturer for pipe material and size. Position pipe in center of sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

2. Inspect installed sleeve and sleeve-seal installation for damage and faulty work. Verify watertight integrity of sleeves and seals installed below grade to seal against hydrostatic pressure.

S. Concrete Slab on Grade Penetrations:

1. Provide ½" thick cellular foam insulation around perimeter of raceway passing through concrete foundation. Installation shall extend to 2" above and below the concrete slab.

T. Elevated Floor Penetrations of waterproof membrane:

1. Provide cast-iron wall pipes for sleeves. Size wall pipe for minimum ½" annular space between wall pipe and cable or raceway.

2. Pack with mineral wool and seal both ends with minimum of ½" of waterproof sealant.

3. Secure waterproof membrane flashing between clamping flange and clamping ring.

4. Extend bottom of wall pipe below floor slab as required and secure underdeck clamp to hold wall pipe rigidly in place.

U. Interior Foundation Penetration: Provide sleeves for horizontal raceway passing through or under foundation. Sleeves shall be cast iron soil pipe two normal pipe sizes larger than the pipe served.

V. Interior Penetrations of Non-Fire-Rated Walls: Seal annular space between sleeve and cable or raceway, using joint sealant appropriate for size, depth, and location of joint. Pack with mineral wool and seal both ends with minimum of ½" of sealant.

W. Exterior Wall Penetrations: Seal annular space between sleeve and raceway or duct, using joint sealant for size, depth, and location of joint. Pack with mineral wool and seal both ends with minimum of ½" of waterproof sealant.

X. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

Y. Sleeve-Seal Installation

1. Install sleeve seals for all underground raceway penetrations through walls at elevations below finished grade. Additionally, install seals inside raceways, after conductors or cables have been installed, in all raceway penetrations through walls at elevations below finished grade.

2. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or

cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

Z. Inspect installed sleeve and sleeve-seal installations for damage and faulty work. Verify watertight integrity of sleeves and seals installed below grade and above grade where installed to seal against hydrostatic pressure.

AA. Sleeves shall be protected throughout the course of construction, and when damaged shall be replace and/or repaired to a satisfactory condition.

3.4 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire/smoke-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.5 JOINT SEALERS

A. Preparation for Joint Sealers

1. Clean surfaces of penetrations, sleeves, or both, immediately before applying joint sealers, to comply with recommendations of joint sealer manufacturer.

2. Apply joint sealer primer to substrates as recommended by joint sealer manufacturer. Protect adjacent areas from spillage and migration of primers, using masking tape. Remove tape immediately after tooling without disturbing joint seal.

B. Application of Joint Sealers

1. General: Comply with joint sealer manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.

   a. Comply with recommendations of ASTM C 962 for use of elastomeric joint sealants.

   b. Comply with recommendations of ASTM C 790 for use of acrylic-emulsion joint sealants.

2. Tooling: Immediately after sealant application and prior to time shining or curing begins, tool sealants to form smooth, uniform beads; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

C. Installation of Fire-Stopping Sealant: Install sealant, including forming, packing, and other accessory materials, to fill openings around electrical raceways penetrating floors and walls, to provide fire-stops with fire-resistance ratings indicated for floor or wall assembly in which penetration occurs. Comply with installation requirements established by testing and inspecting agency.

END OF SECTION 260500

SECTION 260502 - EQUIPMENT WIRING SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This Section includes limited scope for electrical connections to equipment specified under other sections or divisions, or furnished under separate contracts or by the Owner.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Unless otherwise noted, perform all electrical work required for the proper installation and operation of equipment, furnishings, devices and systems specified in other divisions of these Specifications, furnished under other contracts, and/or furnished by the Owner for installation under this contract.

B. Coordinate with work described in Division 11 Sections for equipment requiring electrical connection.

C. Coordinate with work described in Division 23 Section “Common Work Results for HVAC”.

D. Obtain and review shop drawings, product data, and manufacturer's instructions for equipment furnished under other sections.

E. Determine connection locations and rough-in requirements based on shop drawings.

F. Sequence rough-in of electrical connections to coordinate with installation schedule for equipment.

G. Sequence electrical connections to coordinate with start-up schedule for equipment.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Division 01 and Division 26 Section “General Electrical Requirements”.

B. Product data for the following products for:

1. Special connectors
2. Special conductors or cable assemblies.

C. Shop drawings for:

1. Detailing electrical characteristics, wiring diagrams, fabrication and installation for wiring systems.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories:

1. Listed and labeled as defined in NFPA 70, Article 100, by an NRTL as defined by OSHA in 29 CFR 1910.7, and that is acceptable to Authorities Having Jurisdiction.

2. Marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS AND MATERIALS

2.1 CORDS AND CAPS

A. Attachment Plugs: Conform to NEMA WD 1.

B. Configuration: NEMA WD 6, matching receptacle configuration at outlet provided for equipment, or as required by the equipment manufacturer.

C. Cord: See Paragraph “Flexible Cords” in Division 26 Section “Low-voltage Electrical Power Conductors and Cables”.

D. Provide cord size suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify conditions of equipment and installation prior to beginning work.

B. Verify that equipment is ready for connecting, wiring, and energizing.

3.2 INSTALLATION, GENERAL

A. Install in accordance with manufacturer’s instructions.

B. Provide fire-resistive protective assembly or an electrical circuit protective system for feeders and control circuit conductors and cables having a fire-resistance rating of not less than 2 hours where required by NFPA or local building codes. Types of systems requiring a fire-resistive protective assembly include, but are not limited to:

1. Smoke Removal systems

3.3 ELECTRICAL DEVICES

A. Install disconnect switches, controllers, control stations, and control devices (other than temperature control devices) as indicated, specified in other divisions of these Specifications, furnished under other contracts, and/or furnished by the Owner for installation under this Contract.

3.4 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturers' instructions.

B. Make conduit connections to equipment using flexible conduit. Use liquid tight flexible conduit with watertight connectors in damp or wet locations.

C. Make wiring connections using conductors and cable with insulation suitable for temperatures encountered in heat producing equipment.

D. Provide receptacle outlet where connection with attachment plug is indicated. Provide cord and cap where field-supplied attachment plug is indicated on the Drawings.

E. Provide suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

F. Provide interconnecting conduit and wiring between devices and equipment where indicated on the Drawings.

3.5 EQUIPMENT

A. When equipment is delivered in separate parts and field assembled, internal wiring, indicated on Shop Drawings as field wiring, will be provided by the equipment supplier, unless otherwise noted.

B. Provide power connection to all equipment as required and as indicated in the equipment supplier's installation drawings.

C. Provide all control and interlock wiring for all equipment that is not included within the responsibility of Division 22 or 23.

D. Motorized Damper: Provide lockable toggle, pilot lighted disconnect switch in an accessible location at each motor actuator, or group of motor actuators.

END OF SECTION 260502

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Conductors, cables, and cords rated 600V and less.

B. Connectors and terminations rated 600V and less.

1.2 DEFINITIONS

A. The following abbreviations apply to this and other Sections of these specifications:

1. MC: Metal Clad
2. NBR: Acrylonitrile-butadiene rubber
3. NETA ATS: Acceptance Testing Specification.

B. The following definitions apply to this and other Sections of these Specifications:

1. HOMERUN: That portion of an electrical circuit beginning at a junction box, termination box, receptacle or switch with termination at an electrical panelboard.

1.3 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 and temperature deration.
2. Coordinate routing of power, low-voltage, and control conduits requiring fire-resistive protective assembly or electrical circuit protective system. Fire-resistive protective assembly or electrical circuit protective system for power, low-voltage, and control circuit conductors and cables shall have a fire-resistance rating of not less than 2 hours and shall be provided where required by NFPA or local building codes. Types of systems requiring a fire-resistive protective assembly include, but are not limited to:
    a. Feeders for Emergency Power systems where in areas not protected by an automatic fire suppression system.
    b. Smokeproof Enclosure Pressurization systems
    c. Smoke Control systems
    d. Smoke Removal systems
    e. Fire service and Occupant Evacuation Elevator systems
3. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
4. Coordinate electrical testing of electrical, mechanical, and architectural items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

B. Notify Contract Administrator of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Division 01 and Division 26 Section "General Electrical Requirements":

1. Product data for the following products:

a. Conductors, cables, and cords rated 600V and less.

2. Shop drawings for:

a. Fire-Resistive cables, including UL 2196 certification.

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. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

E. Qualification Data: For testing agency.

F. Field quality-control test reports in accordance with NETA ATS:

1. Submit all system and component test results.

G. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.

H. Operation and Maintenance Data: For cable and all accessories to include in operation and maintenance manuals.

I. Follow-up service reports.

1.5 QUALITY ASSURANCE

A. Materials shall be manufactured by companies that have been specializing in the products specified in this Section, for a minimum of 3 years.

B. Provide products listed and classified by Underwriters Laboratories, Inc (UL) as suitable for the purpose specified and indicated.

C. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

D. Test Equipment Suitability and Calibration: Comply with NETA ATS, "Suitability of Test Equipment" and "Test Instrument Calibration."

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

F. Comply with NFPA 70.

1.6 PROJECT 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 Contract Administrator and obtain direction before proceeding with work.

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner, or others, unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Contract Administrator and the Owner no fewer than 7 days in advance of proposed interruption of electrical service.

2. Do not proceed with interruption of electrical service without Contract Administrator and the Owner’s written permission.

3. Owner reserves the right to require Contractor to cease work in any area Owner requires access to on an emergency basis.

C. Make every effort to schedule outages during non-business or off-peak business hours to minimize disruptions to business operations.

1.7 DELIVERY, STORAGE, AND HANDLING

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

1.8 SEISMIC REQUIREMENTS

A. Seismic bracing, restraints, and controls for all electrical systems specified herein shall be designed and installed as required by Division 26 Section “Seismic Controls for Electrical Systems” and Division 20 Section “Seismic Controls for MEP/F/T Systems”.

PART 2 - PRODUCTS AND MATERIALS

2.1 CONDUCTORS AND CABLES - GENERAL

A. Conductor Material: Annealed (soft) copper complying with ICEA S-95-658/NEMA WC70 and UL Standards 44 or 83, as applicable.

1. Solid conductors for No. 10 AWG and smaller; concentric, compressed stranded for No. 8 AWG and larger

2. Stranded for all flexible cords, cables, and control wiring.

3. As noted otherwise below.

B. Aluminum conductors are not allowed.

C. Conductor Insulation: Type THHN/THWN-2 or XHHW-2 complying with ICEA S-95-658/NEMA WC70 or as noted otherwise below.

D. Sizes of conductors and cables indicated or specified are American Wire Gage (Brown and Sharpe).

E. Conductors shall not be smaller than No. 12 AWG, with the exception of wiring for signal and pilot control circuits; and pre-manufactured whips for light fixtures which may be No. 14 AWG.

F. Conductors installed for site electrical work shall be no smaller than No. 10 AWG CU. All site electrical branch circuit wiring shall be sized such that the maximum branch circuit voltage drop is less than 3 percent.

G. Unless indicated otherwise, special purpose conductors and cables, such as low voltage control and shielded instrument wiring, shall be as recommended by the system equipment manufacturer.

H. Refer to Part 3 "Conductor and Insulation Applications" Article for insulation type, cable construction, and ratings.

2.2 SINGLE CONDUCTORS

A. Manufacturers:

1. Alan Wire
2. Cerrowire
3. Colonial Wire & Cable Co., Inc.
4. Encore Wire Corporation
5. General Cable (Prysmian Group)
6. Northern Cables Inc.
7. Okonite Company
8. Southwire Company

B. 600V, insulated conductors as noted above shall be color-coded as follows, unless noted otherwise:

Phase	208Y/120V	480Y/277V
A	Black	Brown
B	Red	Orange
C	Blue	Yellow
Neutral	White	Gray**
Equipment Ground	Green	Green
Isolated Ground	Green/Yellow Stripe	Green/Yellow Stripe

**Except as provided in NFPA 70.

2.3 TWO-HOUR FIRE RESISTIVE CABLES (INDIVIDUAL CONDUCTORS)

A. Manufacturers:

1. Radix Wire & Cable (DuraLife)

B. Certified to UL2196 for Two-Hour Fire Resistive Cable.

C. Cable shall be NFPA 70 compliant for use in a listed fire-resistive cable assembly and must be installed in a system meeting Electrical Circuit Integrity System (FHIT) No. 28C or 28E of the UL Fire Resistance Directory.

D. Two-hour Certified for both vertical and horizontal installations.

E. Conductors: Stranded soft-drawn copper, Thermal/fire barrier tape, silicone inner layer, LSZH XLPO outer layer, Rated 90 degree C.

2.4 METAL CLAD CABLE; TYPE MC

A. General:

1. Shall not be used on this project.

2.5 VARIABLE-FREQUENCY DRIVE CABLE

A. Manufacturers:

1. Belden
2. Service Wire Co.; ServiceDrive

B. Flexible motor supply cable listed and labeled as complying with UL 2277 in accordance with NFPA 79; specifically designed for use with variable frequency drives and associated nonlinear power distortions.

1. Insulation shall be thermoset types. Thermoplastic insulation types are not permitted.
2. Grounding: Full-size integral equipment grounding conductor or symmetrical arrangement of multiple conductors of equivalent size.
3. Provide 100% coverage copper tape shielding.
4. Jacket: PVC or Chlorinated Polyethylene (CPE).

2.6 FLEXIBLE CORDS

A. Manufacturers:

1. Cerrowire
2. Southwire

B. 600V, multi-conductor (2, 3, or 4 as indicated on the Drawings), oil-resistant yellow jacket, extra-hard-usage; Type STO for indoor dry and damp locations; STOW for damp, wet, and outdoor locations; or as required by the manufacturer of the equipment to which the cords are connected.

C. 300V, multi-conductor (2, 3, or 4 as indicated on the Drawings), oil-resistant black jacket, hard-usage; Type SJTO for indoor dry locations; SJTOW for damp, wet, and outdoor locations; or as required by the manufacturer of the equipment to which the cords are connected.

2.7 CONTROL WIRING

A. Refer to Division 23 Section “Direct-Digital Control for HVAC”

B. Unless otherwise noted, all control wiring will be the responsibility of the Section or Division in which the control system is specified.

2.8 CONNECTORS

A. Manufacturers:

1. AMP; Tyco
2. FCI-Burndy
3. Gould
4. Ideal Industries, Inc.
5. Ilsco
6. NSi Industries, Inc.
7. O-Z/Gedney
8. Panduit
9. Thomas and Betts
10. 3-M Electrical Products Division

B. Compression connectors for conductors No. 8 AWG and larger: Long-barreled, UL 486-listed, circumferential compression type (Burndy "Hylug”, or equal), insulated with clamp-on, cold-shrink, or molded covers, or wrapped with multiple over-lapping layers of 3-M Scotch electrical tape.

1. Termination fittings for copper conductors: Bare copper, 1-hole pad and inspection port.

C. Mechanical connections for conductors No. 8 AWG and larger: UL-listed, dual-rated, mechanical type, insulated with clamp-on, cold-shrink, or molded covers, or wrapped with multiple over-lapping layers of 3-M Scotch electrical tape.

1. Termination fittings: Bare copper, 1-hole pad and inspection port.

D. Connectors for solid conductors No. 10 AWG and smaller: Insulated winged wire nuts. Color-coded for size, except use green only for grounding connections.

E. Connectors for stranded conductors No. 10 AWG and smaller: Tinned copper, insulated-sleeve, compression type, UL-listed, with wire insulation grip. Terminations: flanged fork-tongue type.

F. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.

G. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping".

B. Coordinate seals with wall, ceiling, roof or floor materials and rating of the surface (sound, fire, waterproofing, etc.)

C. Electrical conductor and cable work is schematically represented on the Drawings. Unless otherwise indicated, conductor sizes shown on the Drawings are based on not more than three single current-carrying conductors in a raceway in free air. Current ratings are based on copper at 75 degrees C temperature rating for all power circuits. Modify raceway and conductor sizing as may be necessitated by any deviation from these conditions. Do not decrease the indicated conductor size due to the use of conductors having a temperature rating of 90 degrees C.

D. Conductor sizes shown are minimum based on code requirements, voltage drop, and/or other considerations. Where approved by the Engineer and at no extra cost to the Owner, larger conductor sizes may be installed at Contractor's option in order to utilize stock sizes, provided raceway sizes are increased where necessary to conform with NFPA 70 (determine the effect of the use of larger conductors on the short circuit current ratings of the electrical equipment, and provide increased short circuit current rated equipment as required).

E. Where anticipated conductor installed lengths exceed the lengths indicated on the Drawings, notify Contract Administrator. Provide tabulated list of exceeded lengths for review. Increase conductor size, circuit ground size, and conduit size accordingly to meet maximum voltage drop indicated within the calculations.

3.2 INSTALLATION

A. General

1. Unless otherwise indicated on the Drawings on in other Sections, install all conductors in raceway. Install continuous conductors between outlets, devices and boxes without splices or taps. Do not pull connections into raceways. Leave at least 12 inches of conductor at outlets for fixture or device connections.
2. Install in accordance with manufacturer's instructions.
3. Use manufacturer-approved pulling compound or lubricant where necessary; compound used shall not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
4. Use pulling means, including fish tape, cable, rope, and basket weave conductor/cable grips that will not damage conductors/cables or raceway.
5. Where parallel conductors are shown, install each set of conductors in separate raceways of essentially the same length.

6. Seal around cables penetrating fire-rated elements according to Division 07 Section “Penetration Firestopping”.

7. Wiring at Outlets: Install conductors at each outlet with at least 6 inches of slack.

8. Common or Shared Neutrals are not allowed unless shown on the plans or specifically noted to be allowed.

9. Multi-wire branch circuits are not allowed unless noted otherwise on the drawings.

10. Where multi-wire branch circuits are utilized (i.e., shared neutral), shall be provided with a means that will simultaneously disconnect all ungrounded conductors at the point the branch circuit originates. Multi-pole breakers or 3 single pole breakers with a handle tie are two examples.

11. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

12. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

13. When multiple home runs are combined into a single raceway such that the number of conductors exceeds four (conductor count is made up of any combination of phase and neutral conductors), the following restrictions apply (unless shown or noted otherwise on drawings,) which are in addition to those in NFPA 70:

    a. Emergency Power Circuits – includes all circuits covered under Articles 700, 701 and 702.

        1) Maximum of eight conductors in a single raceway. Minimum raceway size: ¾-inch. Do not install any other type of circuit in this raceway.

        2) Only 15A and 20A branch circuit homeruns may be combined into one raceway.

    b. Normal or Non-Essential circuits.

        1) Maximum of 16 conductors in a single raceway. For up to eight conductors in a raceway, minimum raceway size: 3/4 inch. For greater than eight conductors, minimum raceway size: 1 inch. Do not install any other type of circuit in this raceway.

        2) The minimum wire size for all conductors in this raceway: No. 10 AWG.

        3) Only 15A and 20A branch circuit homeruns may be combined into one raceway.

    c. GFCI-protected circuits.

        1) Do not use multi-conductor circuits, with a shared neutral, for any GFCI circuit breaker or receptacle circuit.

14. For branch circuits fed from GFCI circuit breakers, limit the one-way conductor length to 100 feet between the panelboard and the most remote receptacle or load on the GFCI circuit.

15. Where the number of conductors for branch circuits is not shown on the Drawings, determine the number of conductors in accordance with NFPA 70. Provide adequate conductors so as to allow performance of all functions of the device.

16. Provide all conductors with 600V insulation of the following types, unless otherwise noted on the Drawings or in these Specifications:

    a. Wet or dry locations, in raceways:

        1) Service entrance: Type THHN/THWN-2, or XHHW-2.

        2) Feeders and branch circuits: Type THHN/THWN-2, or XHHW-2.

        3) Conductors No. 6 AWG and smaller: Types THHN/THWN-2.

        4) Conductors used between a variable frequency drive (VFD) and associated motor: Type XHHW-2.

B. Two-Hour Fire Resistive Cables (Individual Conductors).

1. Cable shall be installed in a system meeting Electrical Circuit Integrity System (FHIT) No. 28C or 28E of the UL Fire Resistance Directory.

2. Two-Hour Fire-Resistive cable may only be used:

    a. For feeders and branch circuits where a listed fire-resistive cable system is required by NFPA 70, the IBC, or other applicable codes.

3. Two-Hour Fire-Resistive cable shall not be used for any use not listed in the paragraph above. Examples of those uses include, but are not limited to:

    a. In locations not permitted by the NEC.

    b. When specifically not allowed by the local AHJ and/or Owner.

C. Variable-Frequency Drive Cable:

1. Use for conductors run between variable-frequency drive (VFD) and motor when distance exceeds 200 feet.

2. Terminate shielding at both variable-frequency motor controller and associated motor using glands or termination kits recommended by manufacturer.

D. Flexible Cords

1. Refer to Division 26 Section, “Equipment Wiring Systems”, for electrical connections to equipment.

E. Control Wiring

1. Unless otherwise indicated on the Drawings or in other sections, install all control wiring in raceway, regardless of voltage. A qualified Electrician shall install all control wire operating at 120V nominal and above. Control wiring operating at less than 120V (e.g., 12V and 24V) may be installed under the Division furnishing it.

2. Open wiring in air-handling plenums: UL listed and classified for use in air plenums without raceway. Where indicated on the Drawings or otherwise specified, and permitted by local codes, only cable for communication or fire alarm systems and low voltage control wiring may be installed without raceways.

    a. Low voltage wiring not routed in a race way shall be supported by cable tray or j-hooks secured independently of ceiling supports. Cabling shall not be supported directly by the ceiling system.

F. Connections:

1. Apply a zinc based, anti-oxidizing compound to connections.

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

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

4. Use only resin pressure splices and splicing kits that totally encapsulate the splice for splices in underground junction boxes. Arrange the splicing kit to minimize the effects of moisture.

5. Use connectors as indicated in equipment schedules. Where not indicated use connections as noted below.

   a. Compression – Conductors No. 8 AWG and larger to panelboards, switchboards and apparatus

   b. Compression – splices, terminals

   c. Mechanical – where temporary removal is required

6. Do not use terminals on wiring devices to feed through to the next device.

3.3 IDENTIFICATION

A. General: Provide all identification per Division 26 “Identification for Electrical Systems”.

B. Single Conductors: Identify and color-code conductors to indicate voltage and phase according to Part 2 of this Section. Identification method shall be either:

1. Factory provided colored insulation

2. Color-Coding Conductor Tape.

3. On feeders with isolated ground, use colored tape, alternating bands of green and yellow tape to provide a minimum of three bands of green and two bands of yellow.

C. Power-Circuit Conductor Identification: For primary and secondary conductors 1/0 AWG and larger in vaults, pull and junction boxes, manholes, and handholes identify voltage, source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.

D. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in the same junction or pull box identify each ungrounded conductor according to voltage, source and circuit number.

E. Conductors to Be Extended in the Future: Attach identification device to conductors and list source and circuit number.

F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.

3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.

G. Conductors for controls: Label each conductor with Markers for Conductor and Control Cables. – identify conductors using method as noted in Division 26 Section “Identification for Electrical Systems”. Note conductor identification on record Drawings.

H. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

I. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

J. Low voltage cable sheath labels and related manufacturer information shall remain apparent in all exposed applications.

1. Protect exposed cabling labels from painting and overspray (this includes protection of cables in cable tray)

3.4 FIELD QUALITY CONTROL

A. Do not perform insulation resistance tests of the distribution wiring to equipment with the surge protective devices installed. Disconnect surge protective device before conducting insulation resistance tests and reconnect immediately after the testing is over.

B. Testing: Perform the following field quality-control testing:

1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements. Test all wiring prior to energizing to ensure that it is free from unintentional grounds and shorts, is properly phased, and that all connectors are tight.

2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.3. Certify compliance with test parameters.

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

1. Test procedures used.

2. Test results that comply with requirements.

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

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

B. This Section includes:

1. Grounding Electrodes
2. Grounding Conductors
3. Connector Products

1.2 DEFINITIONS

A. The following apply to this and other Sections of these Specifications:

1. Ground ring: Bare underground grounding conductor encircling the building or structure.
2. NETA ATS: Acceptance Testing Specification.
3. PSF: Pounds per Square Foot
4. EMT: Electrical metallic tubing.
5. ENT: Electrical nonmetallic tubing.
6. FMC: Flexible metal conduit.
7. GRS: Galvanized Rigid Steel Conduit
8. IMC: Intermediate metal conduit.
9. LFMC: Liquidtight flexible metal conduit.
10. LFNC: Liquidtight flexible nonmetallic conduit.
11. RAC: Rigid Aluminum Conduit
12. RMC: Rigid Metal Conduit
13. RNC: Rigid nonmetallic conduit.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Division 01 and Division 26 Section “General Electrical Requirements”:

1. Product data for the following products:
    a. Electrodes, mechanical and compression connectors, and exothermic connectors .

B. Qualification Data: For Contractor.

C. Quality-Control Test Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

D. Record Drawings: Submit Record Drawings as required by Division 01 and Division 26 Section “General Electrical Requirements”:

1. Accurately record actual locations of all buried electrodes, bonding conductors and ground rings. Indicate dimensions from fixed structural elements.

1.4 QUALITY ASSURANCE

A. Materials shall be manufactured by companies that have been specializing in the products specified in this Section, for a minimum of 3 years.

B. Test Equipment Suitability and Calibration: Comply with NETA ATS, "Suitability of Test Equipment" and "Test Instrument Calibration."

C. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

D. Electrical Components, Devices, and Accessories:

1. Listed and labeled as defined in NFPA 70, by an NRTL as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
2. Marked for intended use.
3. Comply with UL 467.

E. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.

F. Comply with NFPA 70.

PART 2 - PRODUCTS AND MATERIALS

2.1 GROUNDING CONDUCTORS, CONNECTORS, AND ELECTRODES:

A. Manufacturers:

1. ABB, Inc.
2. Advanced Lightning Technology (ALT)
3. AFL Global
4. Boggs, Inc.
5. Burndy; Hubbell.
6. Cooper Power; Eaton.

7. Copperweld Corp.
8. ECN/Korns; Division of Robroy Industries.
9. Erico; nVent.
10. Galvan Industries, Inc.
11. Greaves Corp.
12. Harger.
13. Hastings Fiber Glass Products, Inc.
14. Heary Brothers Lightning Protection Co.
15. Ideal Industries, Inc.
16. ILSCO.
17. Lightning Master Corp.
18. Lyncole XIT Grounding; Division of VFC.
19. O-Z/Gedney Co.; Emerson.
20. Panduit, Inc
21. RACO; Hubbell, Inc.
22. Robbins Lightning, Inc.
23. Superior Grounding Systems, Inc.

2.2 GROUNDING ELECTRODES

A. Ground Rods: UL-listed:

1. Copper-clad steel; bonded copper electrolytically-applied to minimum thickness of 13 mils.
2. Stainless steel; Type 304.
3. Size: 5/8 inch by 8 feet Provide sectional types when longer rods are indicated.

B. Chemical Electrodes: Copper tube, straight or L-shaped, filled with nonhazardous chemical salts, terminated with a bare conductor sized, at a minimum, for the size of the connecting grounding electrode conductor.

C. Ground Plates: UL-listed, rectangular, bare solid copper plate; minimum 0.032-inch thick.

2.3 GROUNDING CONDUCTORS

A. For insulated conductors, comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables".

B. Material:

1. Copper-clad aluminum.
2. Copper.

C. Equipment Grounding Conductors: Insulated and identified as indicated in Part 3 of this section.

D. Grounding Electrode Conductors: Bare, stranded, unless otherwise indicated.

E. Underground Conductors:

1. Tinned-copper conductor.
2. No. 2/0 AWG minimum
3. Stranded, unless otherwise indicated.

F. Bare Copper Conductors:

1. Solid Conductors: Comply with ASTM B 3
2. Concentric-Lay Stranded Conductors: Comply with ASTM B 8.
3. Tinned Conductors: Comply with ASTM B 33.

G. Copper Bonding Conductors:

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

2.4 CONNECTOR PRODUCTS

A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.

B. Bolted Connectors: Bolted-pressure-type connectors.

C. Compression Connectors: Burndy Hyground, or equal, permanent, pure, wrought copper, meeting ASTM 8 1 87, essentially the same as the conductors being connected; clearly and permanently marked with the information listed below:

1. Company symbol and/or logo.
2. Catalog number.
3. Conductors accommodated.
4. Installation die index number or die catalog number is required.
5. Underwriters Laboratories “Listing Mark:”.
6. The words “Suitable for Direct Burial” or, where space is limited, “Direct Burial” or “Burial” per UL Standard ANSI/UL467.

D. Cast connectors: copper base alloy according to ASTM B 30.

E. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine areas and conditions under which electrical grounding connections are to be made and notify the Contract Administrator and the Engineer in writing of conditions detrimental to proper completion of the work. Do not proceed with Work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:

1. Provide all materials, labor and equipment for an electrical grounding system in accordance with applicable portions of NFPA 70 and NECA. Coordinate electrical work as necessary to interface installation of electrical grounding systems with other work.

2. Accomplish grounding and bonding of electrical installations and specific requirements for systems, circuits and equipment required to be grounded for both temporary and permanent construction.

3. Where the size of the grounding conductors are not shown, size in accordance with NFPA 70 Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Application:

1. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.

2. Underground Grounding Conductors: Unless noted otherwise, bury at least 24 inches below grade, or 6 inches below the official frost line, whichever is greater, or when crossing a duct bank, bury 12 inches above duct bank.

C. Grounding Electrode System: Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.

1. Provide continuous grounding electrode conductors without splice or joint.

2. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.

3. Ground Rod Electrodes:

a. Install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes.

b. Unless otherwise indicated, install ground rod electrodes vertically.

1) Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches below finished grade.

2) Indoor Installations: Unless otherwise indicated, install with 4 inches of top of rod exposed.

c. 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. If depth is unachievable, notify Contract Administrator and Engineer.

d. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make connections without exposing steel or damaging copper coating.

e. Verify that final backfill and compaction has been completed before driving rod electrodes.

f. Install one test well for each service at the ground rod electrically closest to the service entrance. Set top of well flush with finished grade, pavement, or floor.

4. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

5. Metal In-Ground Support Structures: Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.

D. Equipment Grounding Conductors:

1. Comply with NFPA 70, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.

2. Install equipment grounding conductors in all feeders and branch circuits.

3. In branch circuit and feeder raceways, use insulated equipment grounding conductors.

E. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide No. 6 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a ground bar.

2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

F. Separately Derived Systems: Bond the derived neutral (grounded) conductor of all separately derived system (e.g., transformers, generators, UPS) to the nearest available grounding electrode, or back to the service grounding electrode if no approved electrodes are readily available. Size the grounding electrode conductor and bonding jumpers as indicated on the Drawings or as required by NFPA 70, whichever is larger.

G. Bonding: 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:

1. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.
2. Bond each aboveground portion of gas piping system upstream from equipment shutoff valve.
3. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.
4. Bond metallic elements likely to become energized or where indicated on the Drawings, including but not limited to fences around electrical equipment and metal drain bodies near pools or electrical equipment.
5. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding clamp connectors.
6. Common Ground Bonding with Lightning Protection System: Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in PVC conduit.

3.3 CONNECTIONS

A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible. Provide electrical bonding plates, connectors, terminals, lugs and clamps as recommended by the manufacturers for indicated applications. Provide electrical insulating tape, heat-shrinkable insulating tubing, welding materials, and bonding straps as recommended by the manufacturers for types of service indicated.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Replace welds that are puffed up or that show convex surfaces indicating improper cleaning. Use exothermic welded connections for the following:

1. Connecting conductors together.
2. Connecting conductors to ground rods, except at test wells.

3. Connecting conductors to building steel.

4. Connecting conductors to plates.

C. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

1. Compression Fittings: Permanent compression-type fittings may be used for the following rather than exothermic connections:

a. Connecting conductors together, except below grade.

b. Connecting conductors to building steel.

D. Mechanical Pressure-Type Connections: Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

1. Mechanical Pressure Fittings: Use bolted mechanical (removable) pressure-type clamps for the following:

a. Connecting conductors to ground rods at test wells.

b. Connecting conductors to pipes.

E. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

F. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

G. Connections at Test Wells: Use compression-type connectors on conductors and make bolted- and clamped-type connections between conductors and ground rods.

H. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.4 UNDERGROUND DISTRIBUTION SYSTEM GROUNDING

A. Handholes: Install a driven ground rod close to wall and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide a No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.

B. Pad-Mounted Transformers: Install two ground rods and counterpoise encircling the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Use tinned-copper conductor not less than No. 2 AWG for counterpoise and for taps to equipment ground pad. Bury counterpoise not less than 18 inches below grade, or 6 inches below the official frost line, whichever is greater, and 6 inches from the foundation.

3.5 IDENTIFICATION

A. Provide identification as specified in Division 26 "Low-Voltage Electrical Power Conductors and Cables" and "Identification for Electrical Systems".

3.6 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing:

1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests by the fall-of-potential method according to IEEE 81.
3. Provide drawings locating each ground rod and ground rod assembly and other grounding electrodes, identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
4. Inspect and test in accordance with NETA ATS, except Section 4.
5. Perform inspections and tests listed in NETA ATS, Section 7.13.
6. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.
7. Perform point–to–point megohmmeter tests to determine the resistance between the main grounding system and all major electrical equipment frames, system neutral, and/or derived neutral points.
8. Test Values:
    a. The resistance between the main grounding electrode and earth ground shall be no greater than 5 ohms.
    b. Equipment Rated 500 kVA and Less: 10 ohms.
    c. Equipment Rated 500 to 1000 kVA: 5 ohms.
    d. Equipment Rated More Than 1000 kVA: 3 ohms.
    e. Substations and Pad-Mounted Switching Equipment: 5 ohms.
    f. Manhole Grounds: 10 ohms.

9. Minimum system neutral–to-ground insulation resistance: one megohm.

10. Investigate point-to-point resistance values that exceed 0.5 ohms.

    a. Check for loose connections.

    b. Check for absent or broken connections.

    c. Check for poor quality welds.

    d. Consider other reasons.

11. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements

12. Excessive Grounding Electrode Resistance: If measured resistance to earth ground value exceeds specified values, add grounding electrodes and additional conductors as required to obtain the specified value.

13. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.7 GRADING AND PLANTING

A. Restore surface features, including vegetation, at areas disturbed by Work of this Section. Reestablish original grades, unless otherwise indicated. If sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include application of topsoil, fertilizer, lime, seed, sod, sprig, and mulch. Comply with Division 31 and 32. Maintain restored surfaces. Restore disturbed paving as indicated.

3.8 EXISTING INSTALLATIONS

A. Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.

B. Where applicable, verify the neutral and ground are properly bonded at the point of service entrance. Notify the Owner and the Engineer of any existing deficiencies.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.2 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.3 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 Contract Administrator of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
6. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
7. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

B. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Structural members in path of conduit groups with supports.
2. HVAC items, plumbing items and architectural features in the paths of conduit groups with common supports.

C. 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.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1. Submit fabrication drawings and product literature.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

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

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

E. Seismic Requirements: Seismic bracing, restraints, and controls for all electrical systems specified herein shall be designed and installed as required by Division 20 Section “Seismic Controls for MEP/F/T Systems”.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel slotted support systems.
2. Rooftop support systems.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:

1. Trapeze hangers. Include Product Data for components.
2. Steel slotted channel systems. Include Product Data for components.
3. Equipment supports.

C. Welding certificates.

1.6 QUALITY ASSURANCE

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

B. Comply with NFPA 70 and applicable building code.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. General:

1. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.

B. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly. Use corrosion resistant materials suitable for the environment where installed.

1. Manufacturers:

a. Allied Tube & Conduit; Atkore International.

b. Eaton

c. Erico; nVent.

d. GS Metals Corp.

e. Thomas & Betts Corporation.

f. Unistrut; Atkore International.

g. Wesanco, Inc.

2. Metallic Coatings:

a. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

b. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.

3. Channel Dimensions: Selected for applicable load criteria.

C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

D. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

1. Conduit Straps: One-hole or two-hole type.

2. Conduit Clamps: Bolted type unless otherwise indicated.

E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Battery-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

a. Manufacturers:

1) Hilti Inc.

2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.

3) MKT Fastening, LLC.

4) Powers Fasteners, Inc;

5) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

a. Manufacturers:

1) Cooper B-Line, Inc.; a division of Cooper Industries.

2) Empire Tool and Manufacturing Co., Inc.

3) Hilti Inc.

4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.

5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.

4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.

5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.

6. Toggle Bolts: All-steel springhead type.

7. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.

H. Wire Rope Hanging Systems:

1. Manufacturers:

a. Gripple.

2. General: Wire rope hanger system shall have a minimum 5 to 1 safety factor based upon the applied working load being supported.

3. Source Limitations: Furnish associated fittings, accessories, and hardware produced by a single manufacturer.

4. Wire Rope: Zinc coated, stainless steel or galvanized steel, with wire thread type as required to support the applied working load being supported. Provide same size wire for all applications based on worst case loading.

5. Accessories: Hanger attachments and structural attachments shall be compatible with wire rope hanger system and shall be by the same manufacturer as the wire rope hanger system.

2.2 FABRICATED METAL CONDUIT OR EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

C. Rooftop support assemblies: Steel pedestals with thermoplastic or rubber bases that rest on top of roofing membrane.

1. Conduit supports: Unless noted otherwise, surface mounted fittings not requiring any attachment to the roof structure and not penetrating the roofing assembly with support fixtures.

2. Equipment supports: Attachment fittings for connection to roof structure.

D. Base Sizes: As required to prevent overturning and to distribute load sufficiently to prevent indentation of roofing assembly.

E. Mounting Height: Provide minimum clearance of 6 inches under supported components to top of roofing.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Unless specifically indicated or approved by the Contract Administrator and Structural Engineer, do not support from roof deck.

C. Where support wires are permitted, identify independent electrical component support wires above accessible ceilings with color distinguishable from ceiling support wires in accordance with NFPA 70.

D. Steel Components: Use corrosion resistant materials suitable for the environment where installed.

1. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.

2. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.

E. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway:

1. Minimum rod size shall be 1/4 inch (6 mm) in diameter, unless otherwise indicated.

a. Equipment Supports: 1/2 inch diameter minimum.

b. Busway Supports: 1/2 inch diameter minimum.

c. Single Conduit larger than 1 inch (27 mm) trade size: 3/8 inch diameter minimum.

d. Trapeze Support for Multiple Conduits: 3/8 inch diameter minimum.

2. Spacing supports for EMT, IMC, and RMC shall be as scheduled in NECA 1, where its Table 1 lists maximum spacings less than stated in NFPA 70.

F. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with:

   a. two-bolt conduit clamps

   b. single-bolt conduit clamps

G. The use of wire rope hanging systems is an acceptable alternate hanging method when installed in strict accordance with manufacturer's instructions. Supported load shall not exceed manufacturer's recommended load rating.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.

C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

D. Install in accordance with manufacturer's instructions.

E. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

F. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

   1. 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.

G. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.

H. Do not use products for applications other than as permitted by NFPA 70 and product listing.

I. Remove temporary supports when no longer required.

J. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

K. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

   1. To Wood: Fasten with lag screws or through bolts.

   2. To New Concrete: Bolt to concrete inserts.

3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.

4. To Existing Concrete: Expansion anchor fasteners.

5. To Steel:

   a. Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts

   b. Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69

6. To Light Steel: Sheet metal screws.

7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

L. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

D. Minimize overhanging materials and protrusions, and provide protective caps and fittings on exposed material ends where:

1. Accessible to untrained personnel.

2. Located within confined spaces.

E. Rooftop support assemblies:

1. Conduit supports: Unless noted otherwise, coordinate installation of support system after roofing materials are complete. Provide adhesive materials to secure conduit supports where required. Where attachment to roof structure is required or otherwise specified, coordinate installation of supports with roofing material installation.

2. Equipment supports: Coordinate installation of supports with roofing material installation.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 "Concrete”."

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

2. Install anchor bolts to elevations required for proper attachment to supported equipment.

3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Comply with requirements in Division 09 “Finishes” for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

D. Inspect support and attachment components for damage and defects. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION 260529

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL REQUIREMENTS

1.1 SECTION INCLUDES

A. This Section includes:

1. Raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.2 DEFINITIONS

A. Terminology used in this specification is as defined below:

1. EMT: Electrical Metallic Tubing
2. FMC: Flexible Metal Conduit
3. GRS: Galvanized Rigid Steel Conduit
4. IMC: Intermediate Metal Conduit
5. LFMC: Liquidtight Flexible Metal Conduit
6. RAC: Rigid Aluminum Conduit
7. RMC: Rigid Metal Conduit
8. RNC: Rigid Nonmetallic Conduit

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of raceway, boxes, or other potential obstructions within the dedicated equipment spaces and working clearances for equipment installed by other trades in accordance with the codes and manufacturer requirements.
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 provide walls suitable for installation of flush-mounted boxes where indicated. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate routing of power, low-voltage, and control conduits requiring fire-resistive protective assembly or electrical circuit protective system. Fire-resistive protective assembly or electrical circuit protective system for power, low-voltage, and control circuit conductors and cables shall have a fire-resistance rating of not less than 2 hours and shall be provided where required by NFPA or local building

codes. Types of systems requiring a fire-resistive protective assembly include, but are not limited to:

a. Feeders for Emergency Power systems.

b. Smoke Control systems

c. Smoke Removal systems

1.4 SUBMITTALS

A. General: Submit the following in accordance with Division 01 and Division 26 Section "General Electrical Requirements".

B. Shop drawings for:

1. Detailing fabrication and installation for custom enclosures.

C. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Structural members in path of conduit groups with supports.

2. HVAC items, plumbing items and architectural features in the paths of conduit groups with common supports.

D. Record Drawings: Submit Record Drawings as required by Division 01 and Division 26 Section "General Electrical Requirements":

1. Accurately record actual routing of all exterior buried raceway and all interior raceways three inches and larger. Indicate dimensions from fixed structural elements.

1.5 QUALITY ASSURANCE

A. Materials shall be manufactured by companies that have been specializing in the products specified in this Section, for a minimum of 3 years.

B. Electrical Components, Devices, and Accessories:

1. Listed and labeled as defined in NFPA 70, Article 100, by an NRTL as defined by OSHA in 29 CFR 1910.7, and that is acceptable to AHJ.

2. Marked for intended use.

C. Comply with NFPA 70.

1.6 SEISMIC REQUIREMENTS

A. Seismic bracing, restraints, and controls for all electrical systems specified herein shall be designed and installed as required by Division 26 "Seismic Controls for Electrical" and Division 20 Section "Seismic Controls for MEP/F/T Systems".

PART 2 - PRODUCTS AND MATERIALS

2.1 CONDUITS, SURFACE MOUNTED RACEWAYS AND ACCESSORIES

A. Metal Conduit and Tubing

1. Manufacturers:
    a. ABB, Inc.
    b. Atkore
    c. American Conduit
    d. Anamet Electrical, Inc.
    e. Electri-Flex Co.
    f. Hubbell (Fittings).
    g. Nucor Tubular Products.
    h. O-Z/Gedney Co.; Emerson.
    i. Southwire Company, LLC
    j. Western Tube and Conduit Corporation.
    k. Wheatland Tube Co.
2. RMC:
    a. GRS: Hot dip galvanized: ANSI C80.1, UL 6.
        1) Plastic-Coated GRS and Fittings: NEMA RN 1, UL-listed. Coating thickness of 0.04 inches (1mm), minimum.
    b. RAC: ANSI C80.5, UL6A.
3. IMC: ANSI C80.6, UL 1242.
    a. Plastic-Coated IMC and Fittings: NEMA RN 1, UL-listed.
4. EMT and Fittings: ANSI C80.3, UL 797. Only steel products allowed. Reduced wall EMT is not allowed.
    a. Fittings: Compression type. Setscrew may be used in dry locations on conduits over 2-1/2".
5. FMC: Zinc-coated steel: UL 1. Reduced wall FMC is not allowed.
6. LFMC: Flexible steel raceway with PVC jacket: UL 360.
    a. Fittings: NEMA FB 1; compatible with raceway and tubing materials.

B. Nonmetallic Raceway

1. Manufacturers:
    a. ABB, Inc.
    b. American Pipe and Plastics, Inc.
    c. Anamet Electrical, Inc.
    d. Atkore
    e. Cantex Inc.

f. Carlon

g. Electri-Flex Co.

h. Hubbell Inc. (Fittings)

i. IPEX USA, LLC.

j. Prime Conduit.

k. Southwire Corporation.

l. Superflex Ltd.

2. RNC: Schedule 40 PVC: NEMA TC 2, UL 651.

a. Fittings: match to raceway and tubing type and material: NEMA TC 3, NEMA TC 6, UL 651, as applicable.

2.2 BOXES, ENCLOSURES AND CABINETS

A. General

1. Manufacturers:

a. ABB, Inc.

b. American Midwest Power

c. Appleton/O-Z Gedney Co.; Emerson.

d. BEL Products, Inc.

e. Cooper Crouse-Hinds; Eaton.

f. Erickson Electrical Equipment Co.

g. FSR, Inc.

h. Hoffman.

i. Hubbell, Inc.

j. Legrand.

k. Molex; Koch Industries.

l. Robroy Industries, Inc.; Enclosure Division.

m. Spring City Electrical Manufacturing Co.

2. Provide products listed, classified, and labeled as suitable for the purpose intended. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.

3. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.

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. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.

2. Cast Metal Boxes: Comply with NEMA FB 1, Type FD, with gasketed cover. Furnish with threaded hubs.

   a. List and label as complying with UL 514A for non-hazardous locations;

   b. List and label as complying with UL 886 for hazardous locations, where required.

3. 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.

4. Boxes for Ganged Devices: Use multi-gang boxes of single-piece construction. Do not use field-connected gangable boxes.

5. Minimum Box Size, Unless Otherwise Indicated:

   a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.

   b. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep (100 by 38 mm) trade size.

6. Do not use "through-wall" boxes designed for access from both sides of wall.

7. Wall Plates: Comply with Division 26 Section “Wiring Devices”.

C. Junction and Pull Boxes Larger Than 100 cubic inches:

1. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1, and list and label as complying with UL 514A.

2. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast iron or aluminum with gasketed cover.

3. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.

4. Boxes 6 square feet and Larger: Provide sectionalized screw-cover or hinged-cover enclosures.

D. Cabinets and Enclosures:

1. General:

   a. Compliance: NEMA 250, and list and label as complying with UL 50 and UL50E or 508A, as applicable.

   b. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes: Shall be keyed. Provide 2 keys for each enclosure.

      1) All locks shall be keyed alike.

   c. NEMA 250 Environment ratings:

      1) NEMA Type 1: Code-gauge phosphatized steel with continuously welded seams; non-gasketed removable hinged front cover, with flush latch and concealed hinge; collar studs.

      2) NEMA Type 3R: Code-gauge galvanized steel with drip shield top, seam-free front, side, and back; non-gasketed continuous-

hinged door, with stainless steel pin; captive, plated steel cover screws; hasp and staple for padlocking; collar studs.

d. Removable painted steel interior panel mounted on standoffs; metal barriers to separate wiring of different systems and voltages.

e. Provide enclosures wider than 36 inches with double doors; removable center posts; internal bracing, supports, or both, as required to maintain their structural integrity; and, accessory feet where required for freestanding equipment.

f. Provide clamps, grids, slotted wireways, or similar devices to which or by which wiring may be secured. Provide DIN-rail mounted terminal strips for terminating all incoming and outgoing control wiring, and power terminal blocks for incoming/outgoing power wiring. Provide wire management troughs where practicable.

g. Provide metal barriers to separate compartments containing control wiring operating at less than 50 volts from power and higher-voltage control wiring.

2.3 FACTORY FINISHES

A. Interior Finish: All interior components shall be factory finished; manufacturer's standard grey unless otherwise noted.

B. Exterior Finish: For metal enclosure or cabinet components, provide manufacturer's standard paint applied to factory-assembled enclosures and cabinets before shipping.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General

1. Install in accordance with manufacturer's instructions.

3.2 RACEWAYS

A. General

1. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on drawings or in this article are stricter.

2. Provide sizes and types of raceways as indicated on the Drawings. Sizes are based on THWN insulated copper conductors, except where noted otherwise. Where sizes are not shown on the Drawings or in the Specifications, size raceways in accordance with NFPA 70 requirements for the number, size and type of conductors installed. Minimum raceway size: 1/2 inch (concealed and exposed); 1 inch (underground and under slab).

a. 1/2-inch conduit shall contain maximum (5) #12AWG conductors or (3) #10AWG conductors.

b. 3/8-inch flexible conduit may be used for light fixture whips.

3. Provide all raceways, fittings, supports, and miscellaneous hardware required for a complete electrical system as described by the Drawings and Specifications.

4. Install a green-insulated, equipment-grounding conductor, which is bonded to the electrical system ground, in all raceways, with the exception of Service Entrance raceways.

5. Install grounding bushings or other code compliant connections on all conduit terminations and bond to the enclosure, equipment grounding conductor, and electrical system ground.

6. Install raceways concealed in walls or above suspended ceilings in finished areas. When approved by the Contract Administrator, raceways may be installed concealed in elevated floor slabs. Do not install raceways horizontally within slabs on grade.

7. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above the finished slab.

8. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

9. Make bends and offsets so inside diameters are not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.

10. Install raceways:

    a. To meet the requirements of the structure and the requirements of all other Work on the Project.

    b. To clear all openings, depressions, ducts, pipes, reinforcing steel, and so on.

    c. Within or passing through the concrete structure in such a manner so as not to adversely affect the integrity of the structure. Become familiar with the Architectural and the Structural Drawings and their requirements affecting the raceway installation. If necessary, consult with the Contract Administrator.

    d. Parallel or perpendicular to building lines or column lines.

    e. Tight to structure.

    f. When concealed, with a minimum of bends in the shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.

11. Raceways Embedded in Slabs:

    a. Raceways may only be embedded in concrete slabs with written permission from, and only where directed, by the Structural Engineer.

12. Where masonry, brick, CMU or concrete walls in occupied spaces are left unfinished, coordinate raceway installations with other trades so that the raceways and boxes are concealed and the wall will have a neat and smooth appearance.

13. Support raceways from structural elements of the building as required by NFPA 70, Division 26 Section “Hangers and Supports for Electrical Systems”. Do not support raceways by hangers used for any other systems foreign to the electrical

systems; and, do not attach to other foreign systems. Do not lay raceways on top of the ceiling system.

a. Raceways on roof shall be supported from structure not from the roof deck.

14. Provide support spacing in accordance with NFPA 70 requirements, and at a minimum in accordance with NEMA standards. Support by the following methods:

    a. Attach single raceway directly to structural steel with beam clamps.

    b. Attach single raceway directly to concrete with one-hole clamps or clips and anchors. Outdoors and wherever subject to dampness or moisture, offset raceways from the surface by using galvanized clamps and clamp backs, to mitigate moisture entrapment between raceways and surfaces.

    c. Attach groups of raceways to structural steel with slotted support system attached with beam clamps. Attach raceway to slotted channel with approved raceway clamps.

    d. Attach groups of raceways to concrete with cast-in-place steel slotted channel fabricated specifically for concrete embedment. Attach raceway to steel slotted channel with approved raceway clamps.

    e. Hang plumb horizontally suspended single raceway using a threaded rod. Attach threaded rods to concrete with anchors and to structural steel with beam clamps. Attach raceway to threaded rod with approved raceway clamps.

    f. Hang horizontally suspended groups of raceways using steel slotted support system suspended from threaded rods. Attach threaded rods to concrete with anchors and to structural steel with beam clamps. Attach raceway to steel slotted channel with approved raceway clamps.

    g. Support conductors in vertical raceway in accordance with NFPA 70 requirements.

    h. Cross-brace suspended raceway to prevent lateral movement during seismic activity.

    i. Use prefabricated non-metallic spacers for parallel runs of underground or under-slab conduits, either direct buried or encased in concrete.

15. Install electrically and physically continuous raceways between connections to outlets, boxes, panelboards, cabinets, and other electrical equipment with a minimum possible number of bends and not more than the equivalent of four 90-degree bends between boxes. Make bends smooth and even, without flattening raceway or flaking the finish.

16. Protect all electrical Work against damage during construction. Repair all Work damaged or moved out of line after rough-in, to meet the Contract Administrator's approval, without additional cost to the Owner. Cover or temporarily plug openings in boxes or raceways to keep raceways clean during construction. Clean all raceways prior to pulling conductors or cables.

17. Align and install raceway terminations true and plumb.

18. Complete raceway installation before starting conductor installation.

19. Install a pull cord in each empty raceway that is left empty for installation of wires or cables by other trades or under separate contracts. Use polypropylene or

monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull cord.

20. Install approved expansion/deflection fittings where raceways pass through or over building expansion joints; or where structures providing a means of support are subject to relative movement greater than acceptable by the raceway manufacturer.

21. Route raceway through roof openings for piping and ductwork or through roof seals approved by the Contract Administrator, the roofing contractor, or both. Obtain approval for all roof penetrations and seal types from the Contract Administrator, Owner, roofing contractor, or all three as required to maintain new or existing roofing warranties.

22. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

    a. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces or from building exterior to building interior.

    b. Where otherwise required by NFPA 70.

23. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment as required by other requirements of the construction documents.; FMC may be used 6 inches above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.

24. Maintain 2” minimum spacing from bottom of roof deck to prevent raceway penetrations from above.

25. Do not route conduits across skylights, access panels, hatched tiles, HVAC diffusers, or equipment working space.

26. Route conduits serving rooftop equipment concealed inside the equipment curb and minimize roof penetrations and exterior conduit runs where practicable.

27. Install all underground conduits/raceways, outside the building footprint, a minimum of 24” below the bottom of paving/grade, unless noted otherwise, where practicable.

28. Where conduits are subject to earth movement by settlement or frost, provide expansion fittings to prevent damage to enclosed conductors or connected equipment.

29. Provide boxes and raceways for the fire protection system low voltage wiring as required. This includes low voltage wiring exposed less than 96” AFF.

    a. At a minimum, provide 3/4” conduit.

    b. Coordinate requirements and locations with system installer and fire alarm specifications.

B. RMC

1. Use GRS or IMC in the following areas:
    a. Where indicated.
    b. For Emergency Feeders.
    c. Exterior applications where above grade and exposed.
    d. Below grade when concrete-encased, plastic-coated, or provided with a corrosion resistant approved mastic coating.
    e. Concealed within masonry walls.
    f. Damp or wet locations.
    g. Crawl spaces
    h. Interior spaces where exposed.
2. Use RAC in the following areas:
    a. Indoors above grade.
    b. Interior wet or damp locations.
3. Do not use RAC:
    a. Below grade.
    b. Imbedded in concrete or other areas corrosive to RAC.

C. EMT

1. Use EMT in the following areas:
    a. Where indicated.
    b. Interior concealed locations for:
        1) Branch circuits.
        2) Feeders.
        3) Emergency branch circuits.
        4) Low-voltage control, security, and fire alarm circuits
2. Do not use EMT:
    a. Below grade.
    b. In exterior applications when exposed.
    c. In interior applications when exposed in occupied areas.

D. FMC and LFMC

1. Use FMC or LFMC:
    a. For the final 24 inches of raceway to all motors, transformers, and other equipment subject to vibration or movement.
    b. From outlet boxes (attached to building structure) to recessed light fixtures. Install sufficient length to allow for relocating each light fixture within a 5-foot radius of its installed location.

c. Use FMC only in dry locations

d. Use LFMC in damp, wet, corrosive, outdoor locations.

2. Do not use FMC or LFMC:

a. For branch circuits, homeruns or feeders.

b. In lengths exceeding 6 feet.

E. RNC

1. Solvent-weld RNC fittings and raceway couplings per the manufacturer's instructions and make all connections watertight. Use solvent of the same manufacturer as the raceway.

2. Where installed in areas subject to temperature variations, install expansion fittings per NFPA 70, to accommodate thermal expansion in straight runs.

3. RNC is only allowed to be used in the following locations:

a. Underground, single and grouped, in lieu of GRS or IMC, when indicated.

1) Direct buried

F. Telephone and Signal/Data System Raceways, 2-Inch Trade Size and Smaller: In addition to above requirements, install raceways in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.

3.3 RACEWAY FITTINGS

A. Compatible with raceways and suitable for use and location.

B. RMC and IMC: Use threaded rigid steel conduit fittings, unless otherwise indicated.

C. PVC Externally Coated, Rigid Steel Conduits: Use only fittings and installation tools approved by the manufacturer for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits. Replace all fittings and conduits that have any portion of the coating scraped off to bare metal, at no additional cost to the Owner.

D. Join raceways with fittings designed and approved for that purpose and make joints tight.

E. Use insulating bushings to protect conductors at raceway terminations:

1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.

2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.

3.4 BOXES

A. General

1. Verify locations of device boxes prior to rough in.
2. Set boxes at elevations to accommodate mounting heights as specified or indicated on the Drawings.
3. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Adjust box locations to accommodate intended purpose.
4. Install boxes to preserve fire ratings of walls, floors, and ceilings.
5. Install flush wall-mounted boxes without damaging wall insulation or reducing its effectiveness.
6. Support boxes independently of raceway.
7. Clean the interior of boxes to remove dust, debris, and other material. Clean exposed surfaces and restore finish.
8. Adjust flush-mounted boxes to make front edges flush with finished wall material.
9. Provide boxes of the depth required for the service, device and the application, and with raised covers set flush with the finished wall surface for boxes concealed in plaster finishes. Select covers with the proper openings for the devices being installed in the boxes. Install boxes flush unless otherwise indicated.
10. Install outlet boxes in firewalls complying with UL requirements, with box surface area not exceeding 16 square inches; and, when installed on opposite sides of the wall, separate by a distance of at least 24 inches.

B. NEMA Enclosure ratings, Suitable for the environment in which it is installed. At a minimum, provide the following ratings:

1. NEMA 250, type 3R
   a. Provide at exterior locations
2. NEMA 250, type 1
   a. Provide at interior and dry locations

C. Outlet Boxes

1. Locations of outlets on Drawings are approximate; and, except where dimensions are shown, determine exact dimensions for locations of outlets from plans, details, sections, or elevations on Drawings, or as directed by Contract Administrator. Locate outlets generally from column centers and finish wall lines or to centers or joints of wall or ceiling panels.
2. Locate outlet boxes so they are not placed back-to-back in the same wall, and in metal stud walls, so they are separated by at least one stud space, to limit sound transmission from room to room. Install outlet boxes in accessible locations and do not install outlets above ducts or behind furring.
3. Install all electrical devices, such as plug receptacles, lamp receptacles, light switches, and light fixtures in or on outlet boxes Use sheet-steel boxes for dry locations unless otherwise indicated or required.

4. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.

5. Use cast iron boxes or cast aluminum boxes where exposed galvanized steel rigid metal conduit or exposed intermediate metal conduit (IMC) is used.

6. Use cast aluminum boxes where aluminum rigid metal conduit is used.

7. Use suitable concrete type boxes where flush-mounted in concrete.

8. Use suitable masonry type boxes where flush-mounted in masonry walls.

9. Use raised covers suitable for the type of wall construction and device configuration where required.

10. Use shallow boxes where required by the type of wall construction.

11. Install extension and plaster rings as required by NFPA 70.

12. Carefully set outlet boxes concealed in non-plastered block walls so as to line up with wall joints. Coordinate the box and raceway installation with the wall construction as required for a flush and neat appearing installation. Outlet box extensions may be used where necessary.

13. Do not exceed allowable fill per NFPA 70.

14. Where multiple devices are shown grouped together, gang mount with a common cover plate.

D. Junction and Pull Boxes

1. Install junction and pull boxes above accessible ceilings and in unfinished areas.

2. Provide boxes set flush in painted walls or ceilings with primer coated cover.

3. Where junction and pull boxes are installed above an inaccessible ceiling, locate so as to be easily accessible from a ceiling access panel.

4. Boxes for exterior use shall be:

a. Cast iron with cast iron cover sealed and gasketed watertight in vehicular traffic areas. Provide box and cover UL listed for use in vehicular traffic areas.

b. Install buried boxes so that box covers are flush with grade, unless indicated otherwise.

3.5 CABINETS AND ENCLOSURES

A. Unless otherwise indicated on the Drawings, provide

1. NEMA 1 construction for indoor, dry locations

2. NEMA 3R for outdoor locations

B. Install flush mounted in the wall in finished spaces, with the top 78 inches above finished floor. The front shall be approximately 3/4-inch larger than the box all around.

C. Install surface mounted in unfinished spaces, with the top 78 inches above finished floor. The front shall be the same height and width as the box.

D. Electrically ground all metallic cabinets and enclosures. Where wiring to cabinet or enclosure includes a grounding conductor, provide a grounding lug in the interior of the cabinet or enclosure. Cabinets and enclosures specified in this Section are intended to house miscellaneous electrical components assembled in a custom arrangement, such as contactors and relays.

E. All components that are specified or indicated for assembly in cabinets and enclosures shall each be individually UL listed and labeled. Arrange wiring so that it can be readily identified. Support wiring no less than every 3 inches. Install gauges, meters, pilot lights and controls on the face of the door.

F. Do not provide cabinets and enclosures smaller than the sizes indicated. Where sizes and types are not indicated, provide cabinets and enclosures of the size, type and classes appropriate for the use and location per the guidelines of the NEC. Provide all items complete with covers and accessories required for the intended use.

3.6 IDENTIFICATION

A. Refer to Division 26 Section "Identification for Electrical Systems" for identification materials.

B. Raceway Identification:

1. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size. Use the following means of identification:

   a. Self-Adhesive Vinyl Labels

2. Color for Printed Legend:

   a. Power Circuits: Black letters on an orange field.

   b. Legend: Indicate system or service and voltage, if applicable

C. Accessible Raceways, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A: Identification device shall be:

1. Self-adhesive vinyl label

D. Accessible Raceways of Auxiliary Systems: Identify the following systems using the same identification device as other accessible raceways 600V or less, and with the indicated color scheme for each system:

1. Fire Alarm System: Red.

2. Fire-Suppression Supervisory and Control System: Red and yellow.

3. Combined Fire Alarm and Security System: Red and blue.

4. Security System: Blue and yellow.

5. Mechanical and Electrical Supervisory System: Green and blue.

6. Telecommunication System: Green and yellow.

7. Control Wiring: Green and red.

E. Underground Raceways Outside the Building Footprint: Bury warning tape approximately 18 inches above, parallel to raceway.

F. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.

G. Junction Boxes and Pull Boxes:

1. Junction box and pull box covers shall be spray painted to identify the voltage and system. Circuit numbers and the panel they originate from shall be listed on the cover using permanent, waterproof, black ink marker.

2. The junction box where a homerun ends and the circuit is distributed shall be marked. Junction boxes shall be marked approximately every 100 feet along homerun path to panel.

END OF SECTION 260533

SECTION 260548 - SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL REQUIREMENTS

1.1 SECTION INCLUDES

A. This section includes general seismic requirements specific other sections of the Division 26 specifications.

1.2 DEFINITIONS

A. The IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.3 SUMMARY

A. Seismic bracing, restraints, and controls for all electrical systems specified herein shall be designed and installed as required by Division 20 Section “Seismic Controls for MEP Systems”.

B. The following equipment shall withstand the effects of earthquake motions. The equipment will remain in place without separation of any parts from the device when subjected to the seismic forces specified:

1. Panelboards used in normal power systems
2. Raceways and Boxes used in normal power systems
3. Low-Voltage Transformers used in normal power systems
4. Switchboards used in normal power systems
5. Panelboards used in normal power systems

C. In addition to the requirements above, the following equipment shall be fully operational after the seismic event:

1. Panelboards used in emergency power systems
2. Raceways and Boxes used in emergency power systems
3. Low-Voltage Transformers used in emergency power systems
4. Switchboards used in emergency power systems
5. Generators and transfer switches used in emergency power systems

1.4 SUBMITTALS

A. Provide submittals as required by Division 20 Section “Seismic Controls for MEP Systems” for all electrical systems specified herein.

PART 2 - PRODUCTS AND MATERIALS
(Not Used)

PART 3 - EXECUTION
(Not used)

END OF SECTION 260548

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This Section includes the following:

1. Nameplates.
2. Labels for raceways.
3. Labels for junction boxes and pull boxes.
4. Labels for wiring devices.
5. Markers for conductors, and control cables.
6. Underground-line warning tape.
7. Warning labels and signs.
8. Arc Flash Warning Labels.
9. Instruction signs.
10. Miscellaneous identification products.
11. Painted Identification.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Where a facility identification standard already exists, that standard shall be continued. Where an identification standard does not exist, color-coding and identification shall be as described herein.

B. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

C. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

D. Coordinate installation of identifying devices with location of access panels and doors.

E. Install identifying devices before installing acoustical ceilings and similar concealment.

1.3 SUBMITTALS

A. Product Data: Submit the following in accordance with Division 01 and Division 26 Section “General Electrical Requirements” for each electrical identification product indicated:

1. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.
2. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

1.4 QUALITY ASSURANCE

A. Electrical Equipment, Components, Devices, and Accessories:

1. Listed and labeled as defined in NFPA 70, by an NRTL as defined by OSHA in 29 CFR 1910.7 and that are acceptable to authorities having jurisdiction.

2. Marked for intended use.

B. Comply with ANSI A13.1 and ANSI C2.

C. Comply with requirements of NFPA 70.

D. Comply with 29 CFR 1910.145.

PART 2 - PRODUCTS AND MATERIALS

2.1 GENERAL

A. Location, text, and method of identification to be used is noted in individual sections. Refer to other sections for additional identification requirements.

2.2 NAMEPLATES

A. Comply with UL RP 9691, Recommended Practice for Nameplates for Use in Electrical Installations.

B. Engraved, Laminated Acrylic or Melamine Label: Non-conductive phenolic with beveled edges.

1. Adhesive backed.

2. Minimum 1/16 inch (1.6 mm) thick for nameplates with both dimension 4 inches (102 mm) or less and 1/8 inch (3.2 mm) thick for larger sizes.

C. Text: Minimum text height shall be 1/8 inch (3.2 mm) unless otherwise required by local jurisdiction or owner standards. For elevated components, increase sizes of labels and letters to those appropriate for viewing from the floor.

D. Colors:

1. Normal systems - white letters on a black background.

2. Emergency systems - white letters on a red background.

E. Label Requirements:

1. Service Equipment Label
LINE 1: NOMINAL VOLTAGE AND FREQUENCY IN HERTZ
LINE 2: SERVICE EQUIPMENT BUS RATING IN AMPS
LINE 3: SCCR OF SERVICE EQUIPMENT IN AMPS
LINE 4: MAXIMUM AVAILABLE FAULT CURRENT IN AMPS
LINE 5: DATE CALCULATED

EXAMPLE:

208Y/120V, 60HZ
800A
SCCR = 65,000A
MAX AVAILABLE FAULT CURRENT = 58,815A
CALCULATED: 01/01/2018

2. Panelboard/Switchboard Label:
   LINE 1: PANELBOARD/SWITCHBOARD DESIGNATION
   LINE 2: VOLTAGE, PHASE, WIRES, AMPS
   LINE 3: FED FROM " "

EXAMPLES:

H1A
480Y/277V, 3PH, 4W, 200A
FED FROM MDB

L1A
208Y/120V, 3PH, 4W, 225A
FED FROM H1A VIA XFMR T1

3. Transformer Label:
   LINE 1: TRANSFORMER DESIGNATION
   LINE 2: FED FROM " "
   LINE 3: SUPPLIES " "

EXAMPLE:

T1
FED FROM H1A
SUPPLIES L1A

4. Disconnect Switch Label:
   LINE 1: DESIGNATION OF EQUIPMENT SERVED BY DISCONNECT
   LINE 2: VOLTAGE, PHASE, WIRES, AMPS
   LINE 3: FED FROM " "

EXAMPLES:

WATER HEATER WH1
480V, 3PH, 3W, 100A
FED FROM MDB

2.3 LABELS FOR RACEWAYS

A. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.4 LABELS FOR JUNCTION BOXES AND PULL BOXES

A. Junction box and pull box covers shall be spray painted to identify the voltage and system. Circuit numbers and the panel they originate from shall be listed on the cover using permanent, waterproof, black ink marker.

2.5 LABELS FOR WIRING DEVICES AND LIGHTING CONTROL DEVICES

A. Self-laminating Computer Printable Labels: Clear over-laminate to protect legend for permanent, clean identification. Self-laminating Polyester material with white print-on area.

2.6 MARKERS FOR CONDUCTOR AND CONTROL CABLES

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.

B. Self-laminating Computer Printable Labels: Clear over-laminate to protect legend for permanent, clean identification. Self-laminating Polyester material with white print-on area.

2.7 TAGS

A. Write-On Tags: Polyester tag, 0.010 inch (0.25 mm) thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.8 UNDERGROUND-LINE WARNING TAPE

A. Materials: Use foil-backed detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.

B. Foil-backed Detectable Type Tape: 6 inches (152 mm) wide, with minimum thickness of 5 mil, unless otherwise required for proper detection.

C. Legend: Type of service, continuously repeated over full length of tape.

D. Color: Tape for Buried Power Lines: Black text on red background.

2.9 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145. Attachment method shall be acceptable to the manufacturers of the equipment to which the nameplates are being applied and shall not compromise any NRTL listing or labeling criteria.

B. Self-Adhesive Warning Labels: Factory pre-printed or machine-printed multicolor self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.

1. Use thermal transfer process printing machines and accessories recommended by label manufacturer.

2. Do not use labels designed to be completed using handwritten text.

C. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."

2. Workspace Clearance Warning (208 Volts): "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

3. Workspace Clearance Warning (480 Volts): "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 48 INCHES (915 MM)."

2.10 ARC FLASH WARNING LABELS

A. General: All labels will be based on recommended overcurrent device settings and will be printed after the results of the analysis have been presented and after any system changes, upgrades, or modifications have been incorporated in the system. Refer to Division 26 section “Power System Studies” for additional requirements.

B. Materials: Use machine-printed, high adhesion, polyester label; UV, chemical, water, heat, and abrasion resistant, for each work location analyzed.

C. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer. Labels shall be machine printed, with no field markings. 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.

D. Minimum Size: 3.5 inch by 5 inch (89 mm by 127 mm), unless otherwise noted by Owner.

E. Legend: Provide custom legend in accordance with NFPA 70E based on equipment-specific data as determined by arc flash and shock risk assessment. The label shall include the following information, at a minimum:

1. Location designation
2. Nominal voltage
3. Available fault current
4. Limited approach boundary
5. Arc flash boundary
6. Restricted approach boundary
7. Hazard risk category
8. Incident energy
9. Working distance
10. Site-specific PPE (personnel protective equipment) requirements.
11. Date calculations were performed.
12. Engineering report number, revision number and issue date.

2.11 INSTRUCTION SIGNS

A. Engraved, Laminated Acrylic or Melamine plastic: Non-conductive phenolic. Unless indicated otherwise, provide with minimum 3/8-inch- (10-mm-) high letters. For elevated components, increase sizes of labels and letters to those appropriate for viewing from the floor.

1. Minimum 1/16 inch (1.6 mm) thick for nameplates with either dimension greater than 4 inches (102 mm) and 1/8 inch (3.2 mm) thick for larger sizes.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.
4. Normal systems: Engraved legend with white letters on black face.
5. Essential Systems: Engraved legend with white letters on red face.

B. Colors:

1. General Information and Operating Instructions – Black letters on white background.
2. Normal systems - white letters on a black background.
3. Emergency systems - white letters on a red background.

2.12 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength: 50 lb (22.6 kg), minimum.
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black, except where used for color-coding.

B. Fasteners for Nameplates, Labels and Signs

1. Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat lock washers unless otherwise noted.

2.13 PAINTED IDENTIFICATION

A. Paint materials and application requirements are specified in Division 09 painting Sections.

1. Exterior Concrete, Stucco, and Masonry (Other Than Concrete Unit Masonry):
   a. Semi-gloss Acrylic-Enamel Finish: Two finish coat(s) over a primer.
      1) Primer: Exterior concrete and masonry primer.
      2) Finish Coats: Exterior semi-gloss acrylic enamel.
2. Exterior Concrete Unit Masonry:
   a. Semi-gloss Acrylic-Enamel Finish: Two finish coat(s) over a block filler.
      1) Block Filler: Concrete unit masonry block filler.
      2) Finish Coats: Exterior semi-gloss acrylic enamel.

3. Exterior Ferrous Metal:
    a. Semi-gloss Alkyd-Enamel Finish: Two finish coat(s) over a primer.
        1) Primer: Exterior ferrous-metal primer.
        2) Finish Coats: Exterior semi-gloss alkyd enamel.
4. Exterior Zinc-Coated Metal (Except Raceways):
    a. Semi-gloss Alkyd-Enamel Finish: Two finish coat(s) over a primer.
        1) Primer: Exterior zinc-coated metal primer.
        2) Finish Coats: Exterior semi-gloss alkyd enamel.
5. Interior Concrete and Masonry (Other Than Concrete Unit Masonry):
    a. Semi-gloss Alkyd-Enamel Finish: Two finish coat(s) over a primer.
        1) Primer: Interior concrete and masonry primer.
        2) Finish Coats: Interior semi-gloss alkyd enamel.
6. Interior Concrete Unit Masonry:
    a. Semi-gloss Acrylic-Enamel Finish: Two finish coat(s) over a block filler.
        1) Block Filler: Concrete unit masonry block filler.
        2) Finish Coats: Interior semi-gloss acrylic enamel.
7. Interior Gypsum Board:
    a. Semi-gloss Acrylic-Enamel Finish: Two finish coat(s) over a primer.
        1) Primer: Interior gypsum board primer.
        2) Finish Coats: Interior semi-gloss acrylic enamel.
8. Interior Ferrous Metal:
    a. Semi-gloss Acrylic-Enamel Finish: Two finish coat(s) over a primer.
        1) Primer: Interior ferrous-metal primer.
        2) Finish Coats: Interior semi-gloss acrylic enamel.
9. Interior Zinc-Coated Metal (Except Raceways):
    a. Semi-gloss Acrylic-Enamel Finish: Two finish coat(s) over a primer.
        1) Primer: Interior zinc-coated metal primer.
        2) Finish Coats: Interior semi-gloss acrylic enamel.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify identity of each item before installing identification products.

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

C. Provide identification product listed for the location in which it is to be installed.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Painted Identification: Prepare surface and apply paint according to Division 09 painting sections.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. For surfaces that require finish work, apply identification devices after completing finish work. Do not install identification products until final surface finishes and painting are complete.

C. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed. Replace labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

D. Location: Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance without interference with operation and maintenance of equipment. 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.

E. Attach non-adhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.

1. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

F. Equipment Nameplates and Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual.

1. Indoor Clean, Dry Locations: Use plastic nameplates, unless noted otherwise.
2. Outdoor Locations: Use plastic nameplates suitable for exterior use.

G. Install identification products centered, level, and parallel with lines of item being identified.

H. Mark all handwritten text, where permitted, to be neat and legible.

I. For refrigeration systems: Neatly bundle circuits and clearly tag and label each circuit with panelboard, branch circuit designation and refrigeration system number at each termination.

END OF SECTION 260553

SECTION 260573 - OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This Section includes computer-based studies for the following:

1. Short-circuit analysis.
2. Protective device coordination study.
3. Arc flash and shock risk assessment, including arc flash hazard labels.

B. Criteria for selection and adjustment of equipment and associated protective devices not specified in this section, as determined by the studies performed.

1.2 ADMINISTRATIVE REQUIREMENTS

A. The AIC ratings indicated on the Drawings are preliminary and will be finalized based on the results of the short-circuit study. Device ratings for furnished equipment shall be as required by the results of the short-circuit study at no additional cost.

B. Coordination:

1. Existing Installations: Coordinate with equipment manufacturer(s) to obtain data necessary for completion of studies.
2. Coordinate the work to provide equipment and associated protective devices complying with criteria for selection and adjustment, as determined by studies to be performed.
3. Notify Contract Administrator of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

C. Pre-Study Meeting: Conduct meeting with Owner to discuss system operating modes and conditions to be considered in studies.

D. Sequencing:

1. Initial Study:
   a. Study must be completed and submitted for review prior to final order, assembly or shipping of the electrical distribution system components. Do not order equipment until matching study reports and product submittals have both been evaluated by the Contract Administrator.
   b. If study has not been approved prior to shipping, assembly or final ordering of the electrical distribution system components, all changes to the equipment necessitated by the results of the study will be provided by the Contractor at no additional cost to the project.
2. Final Study:
   a. Study must be completed and submitted for review prior to substantial completion. Do not print arc flash labels until final study has been evaluated by the Contract Administrator.

b. Verify naming convention for equipment identification prior to creation of final drawings, reports, and arc flash hazard warning labels.

E. Scheduling:

1. Arrange access to existing facility for data collection with Owner.

2. Where work of this section involves interruption of existing electrical service, arrange service interruption with Owner. Refer to Division 26 section "General Electrical Requirements" for additional requirements.

1.3 SUBMITTALS

A. Product Data: In addition to submittal requirements specified in other sections, include manufacturer's standard catalog pages and data sheets for equipment and protective devices indicating information relevant to studies.

1. Product data for computer software program to be used for studies.

2. Include characteristic time-current trip curves for protective devices.

3. Include impedance data for busway.

4. Include impedance data for engine generators.

5. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.

6. Include documentation of listed series ratings upon request.

7. Identify modifications made in accordance with studies to meet the results of the study.

B. Product Certificates: For coordination-study and short-circuit-study computer software programs, certifying compliance with IEEE 399.

C. Qualification Data:

1. Study Preparer Specialist qualifications.

2. Field Testing Agency qualifications.

D. Arc Flash Hazard Warning Label Samples: One of each type and legend specified.

E. Other Action Submittals:

1. Initial Study report, stamped or sealed and signed by study preparer, including:

a. Cover page including date of study, study methodology, assumptions made and software products used.

b. Study input data, including completed computer program input data sheets.

c. Short-circuit study report.

d. Equipment evaluation report.

e. Coordination-study report.

f. Settings report.

g. Harmonic analysis report.

2. Final Study report, stamped or sealed and signed by study preparer, including:

   a. Cover page including date of study, study methodology, assumptions made, software products used, and summary of changes between initial and final studies.

   b. Study input data, including completed computer program input data sheets.

   c. Short circuit study report.

   d. Equipment evaluation report.

   e. Coordination-study report.

   f. Settings report.

   g. Harmonic analysis report.

   h. Arc-Flash Hazard Analysis, including labels.

3. Certification that field adjustable protective devices have been set in accordance with requirements of studies.

F. Record Drawings: Submit Record Drawings as required by Division 01 and Division 26 Section "General Electrical Requirements":

1. Accurately record on the One-Line Diagram actual ratings and settings for all overcurrent devices, both adjustable and non-adjustable, including all changes made during construction, due to the study, or both.

2. Include computer software files used to prepare studies with file name(s) cross-referenced to specific pieces of equipment and systems.

3. Include copies of previous studies and existing drawings that were obtained during the data collection phase of the study.

1.4 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are not acceptable.

B. Study Preparer Qualifications: An organization experienced in the application of computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. Professional engineer, licensed in the state in which the Project is located, shall be responsible for the study and with a minimum five years experience in the preparation of studies of similar type and complexity using the specified computer software. All elements of the study shall be performed under the direct supervision and control of engineer.

C. Comply with IEEE 399 for general study procedures.

D. Comply with IEEE 141, 242 and 551 for short-circuit currents and coordination time intervals.

E. Comply with IEEE 1584 and NFPA 70E for arc-flash hazard calculations.

F. Field Testing Agency Qualifications: Independent testing organization specializing in testing, analysis, and maintenance of electrical systems with minimum five years' experience; NETA Accredited Company.

PART 2 - PRODUCTS AND MATERIALS

2.1 COMPUTER SOFTWARE DEVELOPERS

A. Computer Software Developers: Subject to compliance with requirements, use the latest commercially available computer software programs utilizing the specified methodologies developed by one of the following:

1. CYME International, Inc. (Eaton): *www.cyme.com*.
2. EasyPower – Part of Bentley Systems: *www.easypower.com*.
3. ETAP/Operation Technology, Inc: *etap.com*.
4. Power Analytics Corporation: *www.poweranalytics.com*.
5. SKM Systems Analysis, Inc: *www.skm.com*.

2.2 COMPUTER SOFTWARE PROGRAM REQUIREMENTS

A. Comply with IEEE 399.

B. Analytical features of short-circuit-study computer software program shall include "mandatory," "very desirable," and "desirable" features as listed in IEEE 399, Table 7-4.

C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices.

1. Zero-Sequence current.
2. Arcing faults.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance. Devices to be coordinated are indicated on Drawings.

B. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices not submitted for approval with coordination study may not be used in study.

C. Short-circuit study and coordination study to be performed prior to the final submittals for any piece of electrical equipment which has an AIC rating or an over-current protective device so that correct equipment gets ordered for the project conditions.

D. Arc Flash Study must be performed after conductors and equipment have been installed and after the project's utility company confirms the available fault current. A final short-

circuit and coordination study with all device settings shall be submitted with the Arc Flash Study. The goal of the revised settings is to minimize the arc flash hazard while maintaining reasonable coordination and selectivity. For the components of emergency and legally required standby system components, full selectivity must be maintained.

3.2 SYSTEM COMPONENTS TO BE INCLUDED IN STUDIES

A. Study shall begin with the utility and each alternate power source overcurrent device(s) serving the Project and end at the last branch circuit overcurrent protective device. This includes studies of the complete paths and operating modes on both sides of any transfer switch, contactor or circuit breaker.

B. Operating modes shall include, where applicable:

1. Utility as a source.
2. Generator as a source.
3. Maintenance settings.

C. Components include, but are not limited to:

1. Switchboards
2. Distribution Panelboards
3. Transfer Switches
4. Panelboards
5. Motor Controllers

3.3 POWER SYSTEM DATA FOR STUDIES

A. 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. Gather and tabulate the following input data to support studies:

1. Product Data for overcurrent protective devices specified in other Division 26 Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Impedance of utility service entrance.
3. Electrical distribution system diagram showing the following:
    a. Indicate load current that is the basis for sizing continuous ratings of circuits for cables and equipment.
    b. Protective Devices: Include circuit-breaker and fuse-current ratings and types;
    c. Protective Relays: Include manufacturer/model, type, settings, current/potential transformer ratio, and associated protective device.
    d. Transformers: Include primary and secondary voltage ratings, kVA rating, winding configuration, percent impedance, and X/R ratio. kilovolt

amperes, primary and secondary voltages, connection type, impedance, and X/R ratios.

e. Generators: Include manufacturer/model, kilovolt amperes, size, voltage, and source impedance.

f. Cables: Indicate conduit material, sizes of conductors, conductor insulation, and length.

g. Motors: Include manufacturer/model, type (e.g. induction, synchronous), horsepower rating, voltage rating, full load amps, and locked rotor current or NEMA MG 1 code letter designation.

4. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram:

a. Special load considerations, including starting inrush currents and frequent starting and stopping.

b. Magnetic inrush current overload capabilities of transformers.

c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.

d. Ratings, types, and settings of utility company's overcurrent protective devices.

e. Special overcurrent protective device settings or types stipulated by utility company.

f. 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).

g. Time-current-characteristic curves of devices indicated to be coordinated.

h. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.

i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.

j. Panelboards, switchboards, motor-control center ampacity, and interrupting ratings in amperes rms symmetrical.

5. Existing Installations:

a. Provide the services of field testing agency or equipment manufacturer's representative to perform field data collection.

b. Collect data on existing electrical distribution system necessary for completion of studies, including field verification of available existing data (e.g. construction documents, previous studies). Include actual settings for field-adjustable devices.

3.4 SHORT-CIRCUIT STUDY

A. Source Impedance: Utility company's fault current contribution as provided by utility.

B. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project and use approved computer software program to calculate values. Include studies of system-switching configurations and alternate operation modes that could result in maximum fault conditions.

C. Calculate momentary and interrupting duties on the basis of maximum available fault current.

D. Comply with IEEE 141 and IEEE 242 recommendations for fault currents and time intervals.

E. Calculations to verify interrupting ratings of overcurrent protective devices shall comply with the following:

1. Low-Voltage Circuit Breakers: IEEE 1015 and IEEE C37.50.
2. Low-Voltage Fuses: IEEE C37.46.
3. Circuit Breakers: IEEE C37.13.

F. Study Report:

1. Enter calculated X/R ratios and interrupting (5-cycle) fault currents on electrical distribution system diagram of the report.
2. Show interrupting (5-cycle) and time-delayed currents (6 cycles and above) on medium-voltage breakers as needed to set relays and assess the sensitivity of overcurrent relays.
3. List other output values from computer analysis, including momentary (1/2-cycle), interrupting (5-cycle), and 30-cycle fault current values for 3-phase, 2-phase, and phase-to-ground faults.

G. Equipment Evaluation Report: Prepare a report on the adequacy of overcurrent protective devices and conductors by comparing short-circuit current ratings of these devices with calculated short-circuit current momentary and interrupting duties. Identify locations where the available fault current exceeds the equipment short circuit current rating, along with recommendations.

3.5 COORDINATION STUDY

A. Perform coordination study and prepare a written report using the results of the short-circuit study and approved computer software program. Comply with IEEE 399.

B. Comply with NFPA 70 for overcurrent protection of circuit elements and devices.

C. Comply with IEEE 141 and IEEE 242 recommendations for fault currents and time intervals.

D. Analyze alternate scenarios considering known operating modes.

E. Transformer Primary Overcurrent Protective Devices:

1. Device shall not operate in response to the following:

a. Inrush current when first energized.

b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.

c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.

2. Device shall protect transformer according to IEEE C57.12.00, for fault currents.

F. Motors served by voltages more than 600 V shall be protected according to IEEE 620.

G. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and conductor melting curves in IEEE 242. Verify adequacy of phase conductors at maximum three-phase bolted fault currents, equipment grounding conductors, and grounding electrode conductors at maximum ground-fault currents.

H. Coordination-Study Report: Prepare a written report indicating the following results of coordination study:

1. Tabular Format of Settings Selected for Overcurrent Protective Devices:

a. Device tag.

b. Relay-current transformer ratios; and tap, time-dial, and instantaneous-pickup values.

c. Circuit-breaker sensor rating; and long-time, short-time, and instantaneous settings.

d. Fuse-current rating and type.

e. Ground-fault relay-pickup and time-delay settings.

2. Coordination Curves: Prepared to determine settings of overcurrent protective devices to achieve the level of selective coordination required in the contract documents or by the edition of the National Electrical Code (including any local jurisdiction amendments) the project must comply with. Graphically illustrate that adequate time separation exists between series devices, including power utility company's upstream devices. Show the following specific information:

a. For protective Devices:

1) Device tags.

2) Circuit Breakers: Include long time pickup and delay, short time pickup and delay, and instantaneous pickup.

3) Protective Relays: Include current/potential transformer ratios, tap, time dial, and instantaneous pickup.

4) Include ground fault pickup and delay.

5) Include fuse ratings.

b. Voltage and current ratio for curves.

c. Three-phase and single-phase damage points for each transformer.

d. No damage, melting, and clearing curves for fuses.

e. Cable damage curves.

f. Generator full load current, overload curves, decrement curves and short-circuit withstand points.

g. Transformer inrush points.

h. Maximum fault current cutoff point.

i. Capacitor full load current and damage curves.

3. Include conclusions and recommendations.

4. Completed data sheets for setting of overcurrent protective devices.

5. For emergency, legally required standby and health care essential power systems, such systems must selectively coordinate to the values indicated below unless local amendments to the National Electrical Code require a different value.

a.	Emergency (NEC article 700)	0.01 seconds
b.	Legally Required Standby (NEC article 701)	0.01 seconds
c.	Elevator Systems (NEC article 620)	0.01 seconds
d.	Health Care Essential Electrical Systems (NEC article 517)	
1)	Equipment Branch	0.10 seconds
2)	Critical Branch	0.01 seconds
3)	Life-Safety Branch	0.01 seconds

3.6 ARC-FLASH HAZARD ANALYSIS

A. Determine arc-flash incident energy levels and flash protection boundary distances based on the results of the Short-Circuit and Coordination studies in accordance with IEEE 1584. Perform the analysis under worst-case arc-flash conditions for all modes of operation.

B. In addition to the requirements outlined in IEEE 1584, the study shall include all equipment rated less than 240 Volts fed by transformers less than 125 kVA in the calculations.

1. Where reasonable, study preparer may assume a maximum clearing time of two seconds in accordance with IEEE 1584, provided that the conditions are such that a worker's egress from an arc flash event would not be inhibited.

2. For single-phase systems, the calculations may be performed assuming a three-phase system in accordance with IEEE 1584, yielding conservative results.

C. For equipment with main devices mounted in separate compartmentalized sections, perform calculations on both the line and load side of the main device.

D. Identify all locations and equipment to be included in the arc-flash hazard analysis:

1. Include a copy of the facility one-line in the report.

2. Identify the possible system operating modes including tie-breaker positions, and parallel generation.

3. Calculate the arcing fault current flowing through each branch for each fault location.

4. Determine the time required to clear the arcing fault current using the protective device settings and associated trip curves.

5. Select the working distances based on system voltage and equipment class.

6. Calculate the incident energy at each fault location at the prescribed working distance.

7. Determine the hazard/risk category (HRC) for the estimated incident energy.

8. Calculate the flash protection boundary at each fault location.

9. Document the assessment in reports and one-line diagrams.

10. Provide labels to be placed on each piece of equipment analyzed. Label shall show the calculated incident energy and hazard/risk category for the calculated incident energy.

E. Results of the arc-flash study shall be summarized in a final report containing the following:

1. Basis, method of hazard assessment, description, purpose, scope, and date of the study.

2. Tabulations of the data used to model the system components and a corresponding one-line diagram.

3. Descriptions of the modes of operation evaluated and identification of the worst case scenario used to evaluate equipment ratings.

4. Tabulations of equipment incident energies, hazard risk categories, and flash protection boundaries. The tabulation shall identify and clearly note equipment that exceeds allowable incident energy ratings.

5. Required arc-flash labeling and placement of labels.

6. Conclusions and recommendations, including recommendations for reducing incident energy at locations where calculated maximum incident energy exceeds 8 calories per sq cm.

3.7 OVERCURRENT PROTECTIVE DEVICE SETTING

A. Manufacturer's Field Service: Engage a factory-authorized service representative, of electrical distribution equipment being set and adjusted, to assist in setting of overcurrent protective devices within equipment.

1. After installing overcurrent protective devices and during energizing process of electrical distribution system, perform the following:

a. Verify that overcurrent protective devices meet parameters used in studies.

b. Adjust devices to values listed in final study results.

c. Adjust devices according to recommendations in Chapter 7, "Inspection and Test Procedures," and Tables 100.7 and 100.8 in NETA ATS.

3.8 INSTALLATION

A. Install arc flash warning labels. Refer to Division 26 section Identification for Electrical Systems for additional requirements.

3.9 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Inspect and test protective devices in accordance with the NETA Acceptance Testing Specification. Certify compliance with test parameters.

C. Overcurrent protection devices will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports, including a certified report that identifies protective device settings have been adjusted in accordance with the requirements of the study. Include notation of conflicts with or deviations made from the studies or the contract documents, deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 260573

SECTION 262200 - LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1500 kVA:

1. Distribution transformers.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate installation of wall-mounting and structure-hanging supports with actual transformer provided.

1.3 SUBMITTALS

A. Product Data: Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, technical certification sheets and performance for each type and size of transformer indicated.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.
2. Transformer ratings including:
    a. kVA
    b. Primary and secondary voltage
    c. Taps
    d. Design impedance
    e. Insulation class and temperature rise

C. Source quality-control test reports.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as

defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

B. Source Limitations: Obtain each transformer type through one source from a single manufacturer.

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

D. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

E. Transformers shall meet the requirements of the most current version of federal law 10 CFR Part 431 "Energy Efficiency Program for Certain Commercial and Industrial Equipment".

F. All transformers shall be UL listed and bear the UL label.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

1.6 INTERRUPTION OF EXISTING ELECTRICAL DISTRIBUTION SYSTEMS:

A. Refer to Division 26 Section “General Electrical Requirements” for procedures regarding interruption of electrical systems.

1.7 SEISMIC REQUIREMENTS

A. Seismic bracing, restraints, and controls for all electrical systems specified herein shall be designed and installed as required by Division 26 “Seismic Controls for Electrical Systems” and Division 20 Section “Seismic Controls for MEP Systems”.

PART 2 - PRODUCTS

2.1 GENERAL TRANSFORMER REQUIREMENTS

A. Manufacturers:

1. ACME Electric Corporation; Power Distribution Products Division
2. Eaton Electrical Inc.; Cutler-Hammer Products.
3. General Electric Company.
4. Hammond Company
5. Siemens Energy & Automation, Inc.
6. Sola/Hevi-Duty
7. Square D; Schneider Electric.

B. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

C. Cores: One leg per phase. Cores shall be constructed of high grade, non-aging silicon steel. The core and coil assembly shall be impregnated with non-hydroscopic, thermosetting varnish and cured to reduce hot spots and seal out moisture. The completed core and coil shall be bolted to the base of the enclosure but isolated by means of rubber, vibration-absorbing mounts. There shall be no metal-to-metal contact between the core and coil and the enclosure. The core of the transformer shall be visibly grounded to the enclosure by means of a flexible grounding conductor or strap sized in accordance with UL and NEC requirements. The neutral shall be brought to a stud to facilitate the required external grounding of the secondary

D. Coils: Continuous windings without splices except for taps.

1. Internal Coil Connections: Brazed or pressure type.

2. Coil Material: Aluminum.

E. Connections to transformers shall be by flexible metal conduit and using flexible couplings.

F. Transformers shall be designed for continuous operation at rated kVA, for 24 hours a day, 365 days a year operation, with normal life expectancy as defined in ANSI C57.96.

G. Wiring/Terminations:

1. Recommended external cable shall be rated 90 degrees C (sized at 75 degrees C ampacity) for encapsulated and 75 degrees C for ventilated designs.

2. Connectors should be selected on the basis of the type and cable size used to wire the specific transformer.

3. Lug kits shall be provided by the Manufacturer of the transformer.

2.2 DISTRIBUTION TRANSFORMERS

A. Comply with NEMA ST 20, and list and label as complying with UL 1561.

B. Enclosures: Unless otherwise specified, transformer enclosures shall be ventilated and be fabricated of heavy gauge, sheet steel construction. Enclosures shall have a baked polyester powder coat finish-gray in color and suitable for interior or exterior applications. Enclosures shall be constructed so that there are no exposed live parts. Enclosures shall have a removable front cover to allow access to internal parts and wiring terminations

1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.

2. Transformer locations:

a. Dry locations:

1) Ventilated

2) NEMA 250, Type 2.

b. Damp or wet:

1) Ventilated. Provide weather shields over ventilation openings.

2) NEMA 250, Type 3R.

3. The maximum temperature of the enclosure shall not exceed 90 degrees C.

4. The maximum temperature of the top of the enclosure shall not exceed 50°C rise above a 40°C ambient.

C. Transformer Enclosure Finish: Comply with NEMA 250.

1. Finish Color: ANSI 61 gray.

D. Taps

1. Three-phase Transformers smaller than 24 kVA and all single phase transformers:

a. One 5 percent tap above and one 5 percent tap below normal full capacity

2. Transformers 25 kVA through 500 kVA:

a. Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity.

E. Insulation Class for transformers less than 15 kVA: 185 deg C, UL-component-recognized insulation system with a maximum of 115 deg C rise above 40 deg C ambient temperature.

F. Insulation Class for transformers 15 kVA and larger: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature

G. Energy Efficiency for Transformers Rated 15 kVA and Larger:

1. Complying with the requirements of the most current version of federal law 10 CFR Part 431 "Energy Efficiency Program for Certain Commercial and Industrial Equipment" efficiency levels.

2. Tested in accordance with federal law 10 CFR Part 431.

H. Mounting Methods.

1. Transformers 75 KVA and larger shall be floor mounted unless indicated otherwise. Transformers 45 KVA and smaller may be wall mounted where wall construction is suitable for the load. Floor mounted transformers shall be securely bolted to a 4 inch, concrete housekeeping pad with vibration isolation pads. Wall mounted or suspended transformers shall have a means of isolating vibration from the support.

2. Transformers up through 1000 KVA shall be mounted on elastomeric vibration isolation pads. Pad shall be constructed of neoprene, rubber, glass fiber, or a combination thereof. Pads shall be “ribbed” or “waffled” in texture. Pads shall be selected for smallest durometer (hardness), preferably less than 50. Deflection of pad shall be .25” static minimum. Stack pads until the desired deflection is achieved.

3. Wall Mounting: Manufacturer's standard brackets.

4. Suspended Mounting: See transformer mounting detail on plans.

2.3 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to ANSI C57.12.01 and IEEE C57.12.91.

2.4 FACTORY TESTING

A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of ANSI and NEMA standards.

1. Ratio tests at the rated voltage connection and at all tap connections
2. Polarity and phase relation tests on the rated voltage connection
3. Applied potential tests
4. Induced potential test
5. No-load and excitation current at rated voltage on the rated voltage connection

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.

D. Verify that ground connections are in place and requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install in accordance with manufacturer’s instructions.

B. Floor mounted transformers shall be mounted on a 4 inch concrete housekeeping pad 2 inches larger all around transformer.

C. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.

D. Use flexible conduit under the provisions of Division 26 Section “Raceways and Boxes for Electrical Systems” for connections to transformer case. Minimum flexible conduit length shall be two (2) feet.

E. Mount transformers on vibration isolating pads suitable for isolating the transformer noise from the building structure.

3.3 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 IDENTIFICATION

A. Nameplates: Label each transformer with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems." Nameplates shall be engraved with the following information

1. Transformer name
2. Fed from (primary source)
3. Secondary voltage, phase, wires

B. Warning Labels: Label each panelboard with a warning label indicating NFPA 70 workspace clearance requirements, complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Testing: Perform the field quality-control tests and inspections listed in this section.

B. Tests and Inspections:

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

C. Remove and replace units that do not pass tests or inspections, and retest as specified above.

3.6 ADJUSTING

A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

3.7 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 262200

SECTION 262413 - SWITCHBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes switchboards rated 600 V and less, including the following:

1. Service and distribution switchboards.
2. Surge Protection Devices.
3. Disconnecting and overcurrent protective devices.

1.2 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

B. NETA ATS: InterNational Electrical Testing Association Acceptance Testing Specification.

C. SPD: Surge Protection Device

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordinate layout and installation of switchboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

C. Fault-Current Study, Coordination Study, and Overcurrent Protective Device Settings report must be completed and submitted for review prior to final order, assembly or shipping of the electrical distribution system components. If studies have not been approved prior to shipping, assembly or final ordering of the electrical distribution system components, all changes to the equipment necessitated by the results of the study will be provided by the contractor at no additional cost to the project. Refer to specification section “Power System Studies.”

1.4 SUBMITTALS

A. General: Submit the following in accordance with Division 01 and Division 26 Section “General Electrical Requirements”.

B. Product Data: For each type of switchboard, switching and overcurrent protective device, instrumentation, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, weights, and finishes.

C. Shop Drawings: For each switchboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details, including required clearances, service space around equipment, and attachments to other work. Show tabulations of installed devices, equipment features, and ratings.

    a. Tabulate features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

2. Detail enclosure types and details for types other than NEMA 250, Type 1.

3. Include outline and general arrangement drawing showing dimensions, shipping sections, and weights of each assembled section.

4. Detail bus configuration, current, and voltage ratings, including size and number of bus bars and current rating for each bus. Indicate mains and branches of phase, neutral, and ground buses.

5. Detail short-circuit current rating of switchboard assembly and overcurrent protective devices.

6. Include descriptive documentation of barriers specified for electrical insulation and isolation.

7. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

8. Include schematic and wiring diagrams for power, signal, and control wiring.

9. Include nameplate legends.

10. Include list of materials.

D. Coordination Drawings: Floor plans showing dimensioned layout, required working clearances, and required area above and around switchboard where pipe and ducts are prohibited. Show switchboard layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.

1. For each equipment room, provide dimensioned layout of the electrical equipment within the space, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved.

2. Dimensioned concrete base, outline of switchboard, and conduit entries; including equipment working clearances and manufacturer required access space.

3. Indicate structural members, light fixtures, sprinkler piping and heads, HVAC equipment, ducts and diffusers, plumbing piping and access fittings. Include maintenance access clearances.

4. Location of structural supports for structure-supported raceways and seismic bracing.

5. Location and clearance of electrical equipment and raceways impacting equipment installation.

E. Seismic Qualification Data: For panelboard equipment, accessories, and components, from manufacturer.

1. Certificate of compliance.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

F. Qualification Data: For qualified Installer.

G. Field Quality-Control Reports:

1. Test procedures used.

2. Test results that comply with requirements.

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

H. Sample Warranty: For warranty.

I. Project Record Documents: Record actual installed equipment and circuiting arrangements.

J. Operation and Maintenance Data: For switchboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Routine maintenance requirements for switchboards and all installed components.

2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

3. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

4. Features and operating sequences, both automatic and manual.

5. Video recording of operation training and demonstration.

K. Follow-up service reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E; Employs installers and supervisors who are trained and approved by manufacturer.

B. Test Equipment Suitability and Calibration: Comply with NETA ATS, "Suitability of Test Equipment" and "Test Instrument Calibration."

C. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

D. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards including clearances between switchboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

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

F. Comply with NEMA PB 2.

G. Comply with NFPA 70.

H. Comply with UL 891.

1.6 PROJECT CONDITIONS

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

B. Environmental Limitations:

1. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a. Ambient Temperature: Not exceeding 104 deg F (40 deg C).

b. Altitude: Not exceeding 6600 feet (2000 m).

C. Interruption of Existing Electric Service: Refer to Division 26 section “General Electrical Requirements”

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver switchboards in sections or lengths that can be moved past obstructions in delivery path.

B. Coordinate delivery of equipment to allow movement into designated space.

C. Store in a clean, dry space, protected from weather and so condensation will not form on or in units. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic. Handle carefully in accordance with manufacturer's instructions to avoid damage to equipment components, enclosure, and finish. Provide temporary heating according to manufacturer's written instructions.

D. Handle and prepare switchboard components according to NEMA PB 2.1 and manufacturer's written instructions. Use factory-installed lifting provisions.

1.8 WARRANTY

A. Warranty: Manufacturer’s standard form in which manufacturer agrees to repair or replace components and/or products of the switchboards that fail in materials or workmanship within the specified warranty period.

B. Warranty Period: Three years from date of Substantial Completion.

1.9 SEISMIC REQUIREMENTS

A. Seismic bracing, restraints, and controls for all electrical systems specified herein shall be designed and installed as required by Division 26 “Seismic Controls for Electrical Systems” and Division 20 Section “Seismic Controls for MEP Systems”.

1.10 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Touchup Paint: Two containers of paint matching enclosure finish, each 0.5 pint (250 mL).

PART 2 - PRODUCTS

2.1 GENERAL

A. Manufacturers:

1. ABB Inc.
2. Eaton.
3. Schneider Electric.
4. Siemens Energy & Automation, Inc.

B. Front-Connected, Front-Accessible Switchboards:

1. Main Devices: Fixed, individually mounted.
2. Branch Devices: Panel mounted.
3. Sections front and rear aligned.

2.2 RATINGS

A. Nominal System Voltage: As indicated on the Drawings.

B. Main-Bus Continuous: Ampacity as indicated on the Drawings.

C. Short-Circuit Current Rating (SCCR):

1. Refer to fault-current and coordination study submittal requirements listed in other parts of this section, in addition to specification section “Power System Studies”.
2. Rating value: Rated to interrupt symmetrical short-circuit current available at terminals. Switchboard shall be fully-rated, unless series-rated is indicated on the drawings. SCCR shall not be less than the highest AIC rating of any circuit breaker in switchboard.

2.3 FABRICATION

A. Indoor Enclosures: Steel, NEMA 250, Type 1.

1. Finish: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.

B. Customer Metering Compartment: A separate customer metering compartment and section with front hinged door, for indicated metering, and current transformers for each meter. Current transformer secondary wiring shall be terminated on shorting-type terminal blocks.

C. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.

D. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.

E. Buses and Connections: Three phase, four wire unless otherwise indicated.

1. Bus bars shall connect between vertical sections and between compartments. Cable connections are not permitted.

2. Phase- and Neutral-Bus Material: Silver- or tin-plated, high-strength, electrical-grade aluminum alloy, with copper or tin-plated aluminum circuit-breaker line connections.

3. Main-Phase Bus Size: Ampacity as indicated on drawings, with uniform capacity for entire length of switchboard's main and distribution sections

4. Neutral Bus: 100 percent of phase-bus ampacity, except as indicated. Equip bus with pressure-connector terminations for outgoing circuit neutral conductors.

5. Vertical Section Bus Size: Ampacity equivalent to horizontal bus, with uniform capacity for entire length of vertical section bus.

6. Ground Bus: Hard-drawn copper of 98 percent minimum conductivity, with pressure connector for feeder and branch-circuit ground conductors, minimum size required by UL 891.

7. For solidly-grounded wye systems, provide factory-installed main bonding jumper between neutral and ground busses, and removable neutral disconnecting link for testing purposes.

8. Provide for future extensions from either end of main phase, neutral, and ground bus by means of predrilled bolt-holes and connecting links.

9. Equip distribution sections with full height vertical bussing to accommodate maximum utilization of space for devices.

10. Line-Side Conductor and Feeder Circuit-Breaker Load Terminals: Insulated, rigidly braced, runback bus extensions, of same material as through buses, equipped with mechanical connectors for outgoing circuit conductors unless otherwise indicated on Drawings, suitable for use with conductor material and sizes. Connections shall comply with requirements of Division 26 section “Low-Voltage Electrical Power Conductors and Cables”. Provide load terminals for future circuit-breaker positions at full-ampere rating of circuit-breaker position.

F. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.

G. Service Entrance Equipment:

1. Label: Where used as service entrance equipment, provide NRTL label for use as service equipment for switchboards with one or more service disconnecting and overcurrent protective devices.

2.4 SURGE PROTECTION DEVICES

A. Provide surge protective devices as required by Division 26 Section “Surge Protective Devices”.

2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Ratings:

1. Continuous ampere rating: as indicated on drawings.

2. Voltage and frequency rating: same as switchboard.

3. Short-circuit current rating (SCCR): Same as requirements for switchboard.

4. Ampere Interrupting Current (AIC) rating: Rated to interrupt symmetrical short-circuit current available at terminals. Switchboards shall be fully-rated, unless series-rated is indicated on the drawings.

B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

a. Instantaneous trip.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.

5. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

a. Standard frame sizes, trip ratings, and number of poles.

b. Lugs: Mechanical or compression style as indicated, suitable for number, size, trip ratings, and conductor material.

c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.

C. Insulated-Case Circuit Breaker (ICCB): 100 percent rated, sealed, insulated-case power circuit breaker with interrupting capacity rating to meet available fault current.

1. Fixed circuit-breaker mounting.

2. Two-step, stored-energy closing.

3. Standard-function, microprocessor-based trip units with interchangeable rating plug, trip indicators, and the following field-adjustable settings:

a. Instantaneous trip.

b. Long- and short-time time adjustments.

c. Ground-fault pickup level, time delay, and I^2t response.

4. Control Voltage: as indicated, or as required by control devices per power supply.

D. Arc Flash Mitigation

1. Circuit breakers, 1200 A and larger, shall be provided with an energy-reducing active arc flash mitigation capability. The energy-reducing active arc flash mitigation system shall allow the operator to enable a maintenance mode using a switch which enables a preset accelerated instantaneous override trip to reduce arc flash energy. An LED on the trip unit shall indicate the trip unit is in the maintenance mode.

2. Documentation shall be provided in accordance with the NEC for location of overcurrent device and method of clearing time reduction.

2.6 INSTRUMENTATION

A. Instrument Transformers: IEEE C57.13, NEMA EI 21.1, and the following:

1. Current Transformers: IEEE C57.13; 5 A, 60 Hz, secondary; wound type; single secondary winding and secondary shorting device. Burden and accuracy shall be consistent with connected metering and relay devices.

B. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:

1. Switch-selectable digital display of the following values with maximum accuracy tolerances as indicated:

a. Phase Currents, Each Phase: Plus or minus 1 percent.

b. Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.

c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.

d. Megawatts: Plus or minus 2 percent.

e. Megavars: Plus or minus 2 percent.

f. Power Factor: Plus or minus 2 percent.

g. Frequency: Plus or minus 0.5 percent.

h. Total Harmonic Distortion: 1.0 percent.

i. Waveform Capture: 32 samples per cycle.

j. Accumulated Energy, Megawatt Hours: Plus or minus 2 percent; accumulated values unaffected by power outages up to 72 hours.

k. Megawatt Demand: Plus or minus 2 percent; demand interval programmable from five to 60 minutes.

2. Mounting: Display and control unit flush or semi flush mounted in instrument compartment door.

2.7 IDENTIFICATION

A. Nameplates: Nameplates and label products are specified in Division 26 Section "Identification for Electrical Systems."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine switchboards before installation. Reject equipment that is damaged, or rusted, or have been subjected to water saturation.

B. Examine areas, surfaces, substrates, and elements to receive switchboards with Installer present, for compliance with requirements for installation tolerances, structural support, ventilation, temperature, humidity, and other conditions affecting performance of the Work.

1. Verify that field measurements are as indicated.

2. Verify that manufacturer's written instructions for environmental conditions have been established in spaces where equipment will be installed, before installation begins.

C. Examine roughing-in of conduits and grounding systems to verify the following:

1. Wiring entries comply with layout requirements.

2. Entries are within conduit-entry tolerances specified by manufacturer and no feeders will have to cross section barriers to reach load or line lugs.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install switchboards and accessories according to NEMA PB 2.1 and manufacturer's instructions.

B. Coordinate layout and installation of equipment with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

C. Comply with mounting and anchoring requirements specified in Division 26 Section "Seismic Controls for Electrical Systems."

D. Equipment Mounting: Install switchboards on concrete bases.

1. Concrete Bases: 4 inches (100 mm) high, reinforced, with chamfered edges. Extend base no more than 3 inches (75 mm) in all directions beyond the maximum dimensions of switchboard unless otherwise indicated or unless required for seismic anchor support. Construct concrete bases according to Division 26 Section "Hangers and Supports for Electrical Systems."

2. Anchor switchboards to concrete bases according to manufacturer's written instructions, seismic codes at Project, and requirements in Division 26 Sections "Hangers and Supports for Electrical Systems" and "Seismic Controls for Electrical Systems."

3. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.

4. Install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.

5. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

6. Install anchor bolts to elevations required for proper attachment to switchboards.

E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.

F. Mount equipment plumb and rigid without distortion of enclosure.

G. Install overcurrent protective devices, surge suppression devices and instrumentation.

H. Install filler plates in unused spaces of panel-mounted sections.

I. Arrange conductors in auxiliary compartments and gutters into groups and bundle and wrap with wire ties.

J. Comply with NECA 1.

3.3 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools for control wiring.

3.4 IDENTIFICATION

A. Equipment Nameplates: Label each contiguous main, or entrance, section with equipment nameplate.

B. Device Nameplates: Label each main, feeder and branch circuit device with a nameplate.

C. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Identification for Electrical Systems."

D. Warning Labels: Label each switchboard with a warning label in accordance with NFPA 70 and NFPA 70E.

1. Provide Arc Flash and available fault current warning labels.

3.5 CLEANING

A. After completing equipment installation and before energizing, inspect unit components. Vacuum dirt and debris from interior of equipment; do not use compressed air to assist in cleaning. Remove paint splatters and other spots. Repair exposed surfaces to match original finish.

3.6 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions throughout periods when equipment environment is not controlled for temperature and humidity within manufacturer's stipulated service conditions.

3.7 ADJUSTING

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

B. Set field-adjustable circuit-breaker trip ranges and protective relay trip characteristics as specified in Division 26 Section "Power System Studies."

3.8 FIELD QUALITY CONTROL

A. Testing: Perform the field quality-control tests and inspections listed below:

B. Acceptance Testing Preparation:

1. After installing equipment but before equipment is energized, test for compliance with requirements.
2. Verify that grounding system at the equipment tested at the specified value or less.
3. Test insulation resistance for each bus, component, connecting supply, feeder, and control circuit.
4. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters. After electrical circuitry has been energized, test for compliance with requirements.
2. Complete installation and startup checks according to manufacturer's written instructions.
3. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
4. Complete setup and adjustment of digital metering using manufaturers recommended parameters.
5. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
6. Report results of tests and inspections in writing. Record adjustable settings and measured insulation resistances. Attach a label or tag to each tested component indicating satisfactory completion of tests.

D. Voltage Monitoring and Adjusting: After Substantial Completion, if requested by Owner, but not more than six months after Final Acceptance, perform the following voltage monitoring:

1. During a period of normal load cycles as evaluated by Owner, perform seven days of three-phase voltage recording at the main incoming section of each service entrance switchboards. Use voltmeters with calibration traceable to the National Institute of Science and Technology standards. Voltage unbalance greater than 1 percent between phases, or deviation of any phase voltage from the nominal value by more than plus or minus 5 percent during the test period, is unacceptable.
2. Corrective Action: If test results are unacceptable, perform the following corrective action, as appropriate:
    a. Rebalance loads.
    b. Prepare written request for voltage adjustment by electric utility in accordance with Division 26 section “Provisions for Electric Utility Service”.
3. Retests: Repeat monitoring, after corrective action has been performed, until satisfactory results are obtained.

E. Switchboard will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports, including a certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 262413

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes panelboards rated 600 V and less, including the following:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.
3. Disconnecting and Overcurrent Protective Devices.
4. Surge Protection Devices.

1.2 DEFINITIONS

A. NETA ATS: InterNational Electrical Testing Association Acceptance Testing Specification.

B. SVR: Suppressed voltage rating.

C. SPD: Surge Protection Device

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Concrete, reinforcement, and formwork requirements are specified in Division 03.

C. Initial Fault-Current Study, Coordination Study, and Overcurrent Protective Device Settings report must be completed and submitted for review prior to final order, assembly or shipping of the electrical distribution system components. If studies have not been approved prior to shipping, assembly or final ordering of the electrical distribution system components, all changes to the equipment necessitated by the results of the study will be provided by the contractor at no additional cost to the project. Refer to specification section “Power System Studies.”

1.4 SUBMITTALS

A. General: Submit the following in accordance with Division 01 and Division 26 Section “General Electrical Requirements”.

B. Product Data: For each type of panelboard, switching and overcurrent protective device, furnished accessories and components. Include dimensions and Manufacturer’s technical data on features, performance, electrical characteristics, ratings, weights, furnished options, specialties, accessories, and finishes.

C. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details, including required clearances, service space around equipment, and attachments to other work. Show tabulations of installed devices, equipment features, and ratings.

    a. Tabulate features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

2. Detail enclosure types and details for other than NEMA 250, Type 1.

3. Include general arrangement drawing showing dimensions and weights of each assembled section.

4. Detail bus configuration, current, and voltage ratings, including size and number of bus bars and current rating for each bus. Indicate mains and branches of phase, neutral, and ground buses.

5. Detail short-circuit current rating of panelboard assembly and overcurrent protective devices.

6. Include descriptive documentation of barriers specified for electrical insulation and isolation.

7. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

8. Include schematic and wiring diagrams for power, signal, and control wiring.

9. Include nameplate legends.

10. Include list of materials.

D. Coordination Drawings: Floor plans showing dimensioned layout, required working clearances, and required area above and around panelboards where pipe and ducts are prohibited. Show panelboard layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.

1. For each equipment room, provide dimensioned layout of the electrical equipment within the space, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved.

2. Dimensioned concrete base, outline of panelboard sections, conduit entries, and ground rod locations; including equipment working clearances and manufacturer required access space.

3. Indicate structural members, light fixtures, sprinkler piping and heads, HVAC equipment, ducts and diffusers, plumbing piping and access fittings. Include maintenance access clearances.

4. Location of structural supports for structure-supported raceways, and seismic bracing.

5. Location and clearance of electrical equipment and raceways impacting equipment installation.

E. Seismic Qualification Data: For panelboard equipment, accessories, and components, from manufacturer.

1. Certificate of compliance.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

F. Qualification Data: For qualified testing agency.

G. Field Quality-Control Reports:
1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

H. Manufacturer's field service report.

I. Sample Warranty: For warranty.

J. Project Record Documents: Record actual installed equipment and circuiting arrangements. Record actual routing for underground circuits. Record actual installed location of ground rods.

K. Panelboard Schedules: Submit final panelboard directories.

L. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
1. Routine maintenance requirements for panelboards and all installed components.
2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
3. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.
4. Features and operating sequences, both automatic and manual.

M. Follow-up service reports.

1.5 QUALITY ASSURANCE

A. Test Equipment Suitability and Calibration: Comply with NETA ATS, "Suitability of Test Equipment" and "Test Instrument Calibration."

B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

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

E. Comply with NEMA PB 1.

F. Comply with NFPA 70.

1.6 PROJECT CONDITIONS

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

B. Environmental Limitations:

1. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a. Ambient Temperature: Not exceeding 23 deg F (minus 5 deg C) to plus 104 deg F (plus 40 deg C).

b. Altitude: Not exceeding 6600 feet (2000 m).

C. Interruption of Existing Electric Service: Do not interrupt electric service to occupied facilities. Refer to Division 26 Section “General Electrical Requirements” for allowable outages.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Coordinate delivery of equipment to allow movement into designated space.

B. Store in a clean, dry space, protected from weather and so condensation will not form on or in units. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic. Handle carefully in accordance with manufacturer's instructions to avoid damage to equipment components, enclosure, and finish. Provide temporary heating according to manufacturer's written instructions.

C. Handle and prepare panelboards for installation according to NEMA PB 1 and manufacturer's written instructions. Use factory-installed lifting provisions.

1.8 WARRANTY

A. Warranty: Manufacturer’s standard form in which manufacturer agrees to repair or replace components and/or products of the panelboards that fail in materials or workmanship within the specified warranty period.

B. Warranty Period: Three years from date of Substantial Completion.

1.9 SEISMIC REQUIREMENTS

A. Seismic bracing, restraints, and controls for all electrical systems specified herein shall be designed and installed as required by Division 26 Section “Seismic Controls for Electrical Systems” and Division 20 Section “Seismic Controls for MEP/F/T Systems”.

1.10 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Refer to Division 26 section “Fuses” for spare fuse requirements. At a minimum, include spares for the following:
    a. Fuses for fusible devices.
    b. Potential transformer fuses.
    c. Control power fuses.
2. Touchup Paint: Two containers of paint matching enclosure finish, each 0.5 pint (250 mL).
3. Enclosure Keys: Two for each enclosure type. All distribution equipment keyed alike.

PART 2 - PRODUCTS

2.1 GENERAL

A. Manufacturers:
1. ABB Inc.
2. Eaton.
3. Schneider Electric.
4. Siemens Energy & Automation, Inc.

B. Enclosures: Flush- or surface-mounted cabinets as noted.
1. Rated for environmental conditions at installed location.
    a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
    b. Outdoor Locations: NEMA 250, Type 3R.
2. Hinged Front Cover: Entire front trim hinged to box.
3. Door: Standard door with concealed hinges, within hinged trim cover. Secured with vault-type latch with tumbler lock; keyed alike.
4. Finishes:
    a. Panels and Trim: Steel and galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
    b. Back Boxes: Galvanized steel.
5. Directory Card: Inside panelboard door, mounted in transparent card holder.

C. Incoming Mains Location: Top and/or bottom as required.

D. Buses: Three phase, four wire unless otherwise indicated.
1. Phase, and Neutral Buses:
    a. Material:
        1) Tin-plated aluminum.
            a) Hard-drawn copper, 98 percent conductivity,may be substituted if provided at no additional cost.

b. Size: Ampacity as indicated on drawings, with uniform capacity for entire length of panelboard's sections.

1) Neutral bus: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus

2. Ground Bus: Equipped with connectors for feeder and branch-circuit ground conductors. For busway feeders, extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.

a. Material: Hard-drawn copper, 98 percent conductivity

b. Size: Minimum-size required by UL 67

3. Provide any available breaker mounting space with bussing.

E. Line-Side Conductor Connectors (Lugs):

1. General: Suitable for use with conductor material and sizes. Connections shall comply with requirements of Division 26 Section "Low-Voltage Electrical Power Conductors and Cables".

2. Material: Same as bus material.

3. Capacity rating: Same as associated bus.

4. Type: Provide mechanical type unless otherwise indicated on Drawings, refer to schedules and one-line diagram.

5. Provide properly sized lugs for all equipment, circuit breakers and other electrical devices to accommodate installed conductors. A larger frame, oversized lugs or non-standard product may be required in some instances.

a. Pin adapters may be utilized only as allowed by manufacturer and the authority having jurisdiction.

F. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

H. Short-Circuit Current Rating (SCCR):

1. Refer to fault-current and coordination study submittal requirements listed in other parts of this section, in addition to specification section "Power System Studies".

2. Rating value: Rated to withstand symmetrical short-circuit current available at terminals. Panelboards shall be fully-rated, unless series-rated is indicated on the drawings. SCCR shall not be less than the highest AIC rating of any circuit breaker in panelboard.

2.2 DISTRIBUTION PANELBOARDS

A. Panelboards: NEMA PB 1, power and feeder distribution type.

B. Doors: For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.

C. Mains: As indicated on drawings.

D. Branch Overcurrent Protective Devices:

1. Connection to bus:

a. For Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

b. For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2. Type: Provide types as indicated on drawings and as defined below.

E. Device Ratings:

1. Continuous ampere rating: as indicated on drawings.

2. Voltage and frequency rating: same as panelboard.

3. Short-circuit current rating (SCCR): Same as requirements for panelboard.

4. Ampere Interrupting Current (AIC) rating: Rated to interrupt symmetrical short-circuit current available at terminals. Panelboards shall be fully-rated, unless series-rated is indicated on the drawings.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Panelboards: Circuit breaker type: NEMA PB 1, lighting and appliance branch-circuit type.

B. Mains: As indicated on drawings.

C. Branch Overcurrent Protective Devices:

1. Connection to bus: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

2. Type: Provide types as indicated on drawings and as defined below.

D. Device Ratings:

1. Continuous ampere rating: as indicated on drawings.

2. Voltage and frequency rating: same as panelboard.

3. Short-circuit current rating (SCCR): Same as requirements for panelboard.

4. Ampere Interrupting Current (AIC) rating: Rated to interrupt symmetrical short-circuit current available at terminals. Panelboards shall be fully-rated, unless series-rated is indicated on the drawings.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

   a. Instantaneous trip.

   b. Long- and short-time pickup levels.

   c. Long- and short-time time adjustments.

   d. Ground-fault pickup level, time delay, and I^2t response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.

5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

6. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

   a. Standard frame sizes, trip ratings, and number of poles.

   b. Lugs: Mechanical type unless otherwise indicated on Drawings, suitable for number, size, trip ratings, and conductor materials.

   c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.

   d. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.

   e. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in off position.

   f. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

B. Arc Flash Mitigation

1. Circuit breakers, 1200 A and larger, shall be provided with an energy-reducing active arc flash mitigation capability. The energy-reducing active arc flash mitigation system shall allow the operator to enable a maintenance mode using a switch which enables a preset accelerated instantaneous override trip to reduce arc flash energy. An LED on the trip unit shall indicate the trip unit is in the maintenance mode.

2. Documentation shall be provided in accordance with the NEC for location of overcurrent device and method of clearing time reduction.

2.5 SURGE PROTECTION DEVICES

A. Provide surge protective devices as required by Division 26 Section “Surge Protective Devices”.

B. Panelboards requiring SPD and the location of the devices shall be as indicated on the Drawings.

2.6 IDENTIFICATION

A. Nameplates: Nameplates and label products are specified in Division 26 Section "Identification for Electrical Systems."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine panelboards before installation. Reject equipment that is damaged, or rusted, or have been subjected to water saturation.

B. Examine areas, surfaces, substrates, and elements to receive panelboards with Installer present, for compliance with requirements for installation tolerances, structural support, ventilation, temperature, humidity, and other conditions affecting performance of the Work.

1. Verify that field measurements are as indicated.

2. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment will be installed, before installation begins.

C. Examine roughing-in of conduits and grounding systems to verify the following:

1. Wiring entries comply with layout requirements.

2. Entries are within conduit-entry tolerances specified by manufacturer.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1 and manufacturer’s instructions.

B. Coordinate layout and installation of equipment with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

C. Comply with mounting and anchoring requirements specified in Division 26 Section "Seismic Controls for Electrical Systems."

D. Wall-Mounted Panelboards: Install panelboards on walls with tops at uniform height unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For panelboards not at walls, provide freestanding racks complying with Division 26 Section "Hangers and Supports for Electrical Systems."

E. Floor-Mounted Panelboards: Install panelboards on concrete bases.

1. Concrete Bases: 4 inches (100 mm) high, reinforced, with chamfered edges. Extend base no more than 3 inches (75 mm) in all directions beyond the maximum dimensions of panelboards unless otherwise indicated or unless required for seismic anchor support. Construct concrete bases according to Division 26 Section "Hangers and Supports for Electrical Systems."

2. Anchor panelboards to concrete bases according to manufacturer's written instructions, seismic codes at Project, and requirements in Division 26 Sections "Hangers and Supports for Electrical Systems" and "Seismic Controls for Electrical Systems."

3. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

4. Install anchor bolts to elevations required for proper attachment to panelboards.

5. Attach panelboards to the vertical finished or structural surface behind the panelboards.

F. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

G. Mount top of trim 72 inches (1788 mm)above finished floor unless otherwise indicated.

H. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

I. Install overcurrent protective devices and controllers not already factory installed.

J. Install fuses in fusible devices.

K. Install filler plates in unused spaces.

L. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

M. Comply with NECA 1.

3.3 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools for control wiring.

3.4 IDENTIFICATION

A. Equipment Nameplates: Label each contiguous main, or entrance section with equipment nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

B. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

C. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Identification for Electrical Systems."

D. Warning Labels: Label each panelboard with a warning label in accordance with NFPA 70 and NFPA 70E.

1. Exception: Do not install NFPA 70 working clearance requirements on flush panelboards and similar equipment in finished spaces.

E. Panel Directories

1. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

2. Note the date the directory was created/updated.

3. Create directory after loads have been balanced to reflect actual as-built conditions.

4. Circuit descriptions shall be per code and shall be distinguishable from all others.

5. Replace existing directories with revised type written directories indicating changes.

3.5 CLEANING

A. After completing equipment installation and before energizing, inspect unit components. Vacuum dirt and debris from interior of equipment; do not use compressed air to assist in cleaning. Remove paint splatters and other spots. Repair exposed surfaces to match original finish.

3.6 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

3.7 ADJUSTING

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

B. Set field-adjustable circuit-breaker trip ranges as specified in Division 26 Section "Power System Studies."

3.8 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control tests and inspections:

B. Acceptance Testing Preparation:

1. After installing equipment but before equipment is energized, test for compliance with requirements.

2. Verify that grounding system at the equipment tested at the specified value or less.

3. Test insulation resistance for each bus, component, connecting supply, feeder, and control circuit.

4. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters. After electrical circuitry has been energized, test for compliance with requirements.

2. Verify that electrical control wiring installation complies with manufacturer's submittal by means of point-to-point continuity testing. Verify that wiring installation complies with requirements in Division 26 Sections.

3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

5. Report results of tests and inspections in writing. Record adjustable settings and measured insulation resistances. Attach a label or tag to each tested component indicating satisfactory completion of tests.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Receptacles:

1. Convenience including single and duplex.
2. Ground fault current interrupter type (GFCI)

B. Wall Switches

C. Wall Plates and Covers

D. Emergency Power Off Buttons

1.2 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

B. IG: Isolated Ground

C. TR: Tamper Resistant

D. USB: Universal Serial Bus

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed. This shall apply to equipment furnished under this contract and equipment furnished by Owner or under separate contract.
3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
5. Notify Contract Administrator of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Division 01 and Division 26 Section “General Electrical Requirements”.

B. Product Data:

1. Provide manufacturer's catalog information specifically marked to indicate which devices are being furnished, and showing dimensions, colors, and configurations for all devices, including, but not limited to: Receptacles, AC wall switches, and cover plates.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and associated cover plate from a single manufacturer and through one source. Where practical and possible, obtain all wiring devices and associated cover plates from a single manufacturer and one source.

B. Materials shall be manufactured by companies that have been specializing in the products specified in this Section, for a minimum of 10 years.

C. Electrical Components, Devices, and Accessories:

1. Listed and labeled as defined in NFPA 70, Article 100, by an NRTL as defined by OSHA in 29 CFR 1910.7, and that are acceptable to authorities having jurisdiction.

2. Marked for intended use.

D. Comply with NFPA 70.

PART 2 - PRODUCTS AND MATERIALS

2.1 GENERAL

A. Wiring devices are defined as single discrete units of electrical distribution systems, such as convenience receptacles, switches, special purpose receptacles, and similar, which are intended to carry, but not use electrical energy. Install wiring devices as required by the Specifications and where indicated on the Drawings.

B. Wiring Device Finishes:

1. Provide wiring device finishes as described below, unless otherwise indicated.

2. Wiring devices connected to normal power systems: Gray, unless otherwise indicated or required by NFPA 70. Cover plates: stainless steel.

3. Wiring devices connected to emergency power systems: Red. Cover plates: stainless steel and engraved with "EMERGENCY POWER" with black filler in the engraving..

2.2 RECEPTACLES

A. Manufacturers:

1. Receptacles and Switches:

a. Eaton.

b. Hubbell Incorporated.

c. Legrand.

d. Leviton.

B. Receptacles - General Requirements: Self-grounding, impact-resistant nylon face, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498; types as indicated.

1. Wiring Provisions: Terminal screws for side wiring with separate ground terminal screw.

2. NEMA configurations specified are according to NEMA WD 6.

C. The basis-of-design catalog numbers listed below are generally for 20A rated duplex devices. Where 15A rated devices are indicated on the Drawings or required for circuit rating limitations, provide receptacles equivalent to those specified for 20A, but rated for 15A. Where simplex devices are indicated on the drawings, provide similar, but simplex receptacle.

D. Convenience Receptacle:

Type - Duplex Convenience Receptacle	Commercial Specification Grade
Standard Duplex	Legrand CR20 or CRB5362
Tamper-Resistant	Legrand TR220 or TR5352
Weather-Resistant/Tamper-Resistant	Legrand WR20TR

E. GFCI Receptacles:

1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.

a. Provide test and reset buttons of same color as device.

Type - Duplex GFCI	Specification Grade
Tamper-Resistant GFCI	Legrand 2097TR
Weather-Resistant/Tamper-Resistant GFCI	Legrand 2097TRWR
Blank Face	Legrand 2087

2.3 SWITCHES

A. Manufacturers:

1. Receptacles and Switches:

a. Eaton.

b. Hubbell Incorporated.

c. Legrand.

d. Leviton.

B. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20; types as indicated on the drawings

1. Wiring Provisions: Terminal screws for side wiring with separate ground terminal screw.

C. The basis-of-design catalog numbers listed below are generally for 20A rated devices. Where 15A rated devices are indicated on the Drawings or required for circuit rating limitations, provide switches equivalent to those specified for 20A, but rated for 15A.

D. Standard Wall Switches:

Type - Switches	Commercial Specification Grade
1-Pole	Legrand CS20AC1 or CSB20AC1
2-Pole	Legrand CSB20AC2
3-Way	Legrand CS20AC3 or CSB20AC3
4-Way	Legrand CSB20AC4

2.4 WALL PLATES AND COVERS

A. Wall Plates: Comply with UL 514D.

1. Match corresponding wiring devices and manufacturer of wiring devices specified herein.
2. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
3. Size: Standard unless otherwise indicated.
4. Screws: Metal with slotted heads finished to match wall plate finish.

B. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

C. Masonry walls and oversized wall openings: Jumbo size plates with same material as indicated above.

D. Weatherproof Receptacle Covers for Wet or Damp Locations: Gasketed, cast aluminum with hinged lockable cover for horizontal mounting and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type. (Covers listed are single-gang for GFCI device, 2-gang or other device similar.) Back box must be suitable for conduit connections. Coordinate back box with wall depth.

Weatherproof cover for Wet Location In-Use	Cast Aluminum
Horizontal	Hubbell WP26EH

2.5 EMERGENCY POWER OFF BUTTONS

A. Manufacturers:

1. ABB
2. Eaton
3. Schneider Electric

B. Push Button Operators: 30MM, watertight/oiltight, heavy duty, 600V maximum ac/dc, 10A continuous, momentary, non-illuminated, shrouded push button operator. Provide with 1 normally open and 1 normally closed contact block.

Basis of Design: Schneider Electric 9001KR1RH13.

PART 3 - EXECUTION

3.1 GENERAL

A. Outlets are only approximately located on the small scale Drawings. Use great care in the actual location by consulting the various large scale detailed Drawings used by other Division trades, and by securing definite locations from the Contract Administrator.

B. Do not use multi-conductor circuits, with a shared neutral, for any GFCI receptacle circuit. Provide a separate neutral conductor with all GFCI receptacle circuits.

C. Provide twist-locking type receptacles or other special type receptacles where indicated on the Drawings.

3.2 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring

E. Verify that conditions are satisfactory for installation prior to starting work.

3.3 PREPARATION

A. If required, provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.4 INSTALLATION

A. Install in accordance with manufacturer’s instructions.

B. Install all wiring devices plumb, level, and square with building lines. Wiring device bodies shall extend to the finished surface of the walls, ceiling or floor, as applicable, without projecting beyond them.

C. Connect wiring devices by wrapping conductors around screw terminals. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

D. Connect wiring device grounding terminal to branch circuit equipment grounding conductor and bond to metal outlet box. Exception: Do not bond grounding terminals of isolated ground receptacles to the outlet box.

E. Install devices shown on wood trim, cases or other fixtures symmetrically and, where necessary, set with the long dimensions of the plate horizontal, or ganged in tandem.

F. Unless dimensioned otherwise, install wiring devices a minimum of 24 inches from the closest edge of any sink.

G. Install switches with OFF position down.

H. Install cover plates on all switches, receptacles, and blank outlets.

I. Locate wiring devices so that the cover plate does not have to be cut to be installed.

J. Where devices are shown near wall openings, coordinate location if corner guards are to be installed so that cover plates do not require cutting.

K. Install cover plates after the wall has been finished (painted, wall paper, etc).

L. Install device boxes in brick or block walls such that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.

M. Provide engraved nameplate on emergency off buttons.

N. Provide ground fault circuit interruption capability for all 120V receptacles 50A or less and all 208/240V receptacles 100A or less in code required locations. Locations include, but are not limited to: bathrooms, kitchens/food prep areas, exterior locations and within 6' or sinks. Interruption capability can be achieved via a GFCI circuit breaker or a GFCI receptacle.

O. Provide type and quantity of normally open and/or normally closed contacts for emergency off buttons to meet the sequence of operations shown.

P. Install wiring devices shown back-to-back on a common wall offset a minimum of 12" horizontally to reduce sound transmission between rooms.

3.5 MOUNTING HEIGHTS AND ORIENTATION

A. Coordinate locations of outlet boxes provided under Division 26 Section "Common Work Results for Electrical".

B. Unless noted otherwise, install wiring devices at mounting heights indicated in the Electrical Symbols Legend on the construction drawings.

1. Receptacles:

a. General:

1) Unless indicated otherwise, install vertically with the ground slot mounted at the top.

2) Where Installed horizontally, install neutral slot mounted at the top.

b. Above counters:

1) Mount vertically.

c. Mechanical and electrical equipment rooms and janitors closets:

1) Mount vertically.

d. Weatherproof exterior receptacles:

1) Mount horizontally.

e. GFCI receptacles: Same as general receptacles.

f. Concrete Block Walls: Dimensions above may be adjusted slightly, as required to compensate for variable joint dimensions, such that bottom or top of boxes, as applicable, are at block joints.

2. Switches:

a. Above counters: Same as for receptacles.

b. Concrete Block Walls: Dimension may be adjusted slightly, as required to compensate for variable joint dimensions, such that bottom of boxes are at block joints.

c. Walls with wainscoting: 6 inches minimum above wainscoting, but not exceeding 48 inches above finished floor.

3. Telephone/Data Outlet Boxes:

a. General: Match mounting height of adjacent wiring device listed above.

4. Emergency Power Off Buttons and Break Glass Operators:

a. General: Match requirements of switches listed above.

3.6 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."

1. Receptacles and Switches: Identify panelboard and circuit number from which served, using:

a. Durable wire markers or tags inside outlet boxes.

b. Permanent-ink marker, hand-printed legibly, inside outlet boxes.

2. Emergency Power Off Buttons:

a. Provide engraved nameplate on emergency off buttons.

b. Identify equipment, device or system controlled by emergency power off button.

B. Label all devices fed downstream of GFCI protected receptacles as “GFCI PROTECTED”.

3.7 FIELD QUALITY CONTROL

A. Inspect each wiring device for defects.

B. Operate each wall switch with circuit energized and verify proper operation.

C. Verify that each receptacle device is energized. After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements.

D. Test all wiring devices for electrical continuity and proper polarity of connections.

E. Test each GFCI receptacle device for proper operation.

F. Correct wiring devices incorrectly installed.

G. Repair or replace all damaged items or damaged finishes at no expense to the Owner.

3.8 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.9 CLEANING

A. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION 262726

SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Cartridge Fuses

B. Accessories

1. Fuseholders
2. Fuse Reducers

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed and with system short-circuit current levels.
3. Coordinate location of and access to spare fuse cabinet(s) with final electrical equipment layouts within electrical equipment rooms.
4. Notify Contract Administrator of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Initial Fault-Current Study, Coordination Study, and Overcurrent Protective Device Settings report must be completed and submitted for review prior to final order, assembly or shipping of the electrical distribution system components. If studies have not been approved prior to shipping, assembly or final ordering of the electrical distribution system components, all changes to the equipment necessitated by the results of the study will be provided by the contractor at no additional cost to the project. Refer to specification section “Power System Studies.”

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material, dimensions, and descriptions of individual components.

1. Include the following for each fuse type indicated:
    a. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.

B. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. All items requested under “Product Data”.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

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

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

D. Comply with NEMA FU 1 for cartridge fuses.

E. Comply with NFPA 70.

F. Comply with UL 248.

1.5 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (5 deg C) or more than 100 deg F (38 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.6 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.

C. Provide fuses of the same type, rating, and manufacturer within the same switch.

D. Selectivity: Where selectivity is required by the Documents, furnish products as required to achieve selective coordination.

2.2 MANUFACTURERS

A. Manufacturers:

1. Bussmann, a division of Eaton Corporation; www.cooperindustries.com.
2. Littelfuse, Inc.; www.littelfuse.com.
3. Mersen; ep-us.mersen.com.
4. Edison Fuse, Inc; www.edisonfuses.net.

2.3 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

2.4 ACCESSORIES

A. Provide the following accessories where indicated or where required to complete installation:

1. Fuseholders: Compatible with indicated fuses.

2. Fuse Reducers: For adapting indicated fuses to permit installation in switch designed for fuses with larger ampere ratings.

B. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Do not install fuses until circuits are ready to be energized.

B. Install in accordance with manufacturer’s instructions.

C. Install fuses in fusible devices. Arrange fuses so manufacturer, type and rating information is readable without removing fuse.

3.3 FUSE APPLICATIONS

A. Cartridge Fuses:

1. Service Entrance:

a. Greater than 600A:

1) Class L, time delay

b. 600A or less:

1) Class RK1, time delay

2. Feeders:

a. Greater than 600A:

1) Class L, time delay

b. 600A or less:

1) Class RK1, time delay

3. Motor Branch Circuits:

a. Class RK1 time delay

4. Other Branch Circuits:

a. Class RK1, time delay

5. Control Circuits:

a. Class CC fast acting

3.4 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 262813

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fusible switches.

B. Non-fusible switches.

C. Enclosures.

1.2 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordinate layout and installation of enclosed switches, circuit breakers and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Initial Fault-Current Study Coordination Study, and Overcurrent Protective Device Settings report must be completed and submitted for review prior to final order, assembly or shipping of the electrical distribution system components. If studies have not been approved prior to shipping, assembly or final ordering of the electrical distribution system components, all changes to the equipment necessitated by the results of the study will be provided by the contractor at no additional cost to the project. Refer to specification section “Power System Studies”.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Division 01 and Division 26 Section “General Electrical Requirements”.

B. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensions and Manufacturer’s technical data on features, performance, electrical characteristics, ratings, weights, furnished options, specialties, accessories, and finishes.

C. Shop Drawings: For enclosed switches and circuit breakers.

1. Include dimensioned plans, elevations, sections, and details, including required clearances, service space around equipment, and attachments to other work. Show tabulations of installed devices, equipment features, and ratings.

a. Tabulate features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

2. Detail enclosure types and details for other than NEMA 250, Type 1.

3. Include general arrangement drawing showing dimensions and weights of each assembled section.

4. Detail bus configuration, current, and voltage ratings, including size and number of bus bars and current rating for each bus. Indicate mains and branches of phase, neutral, and ground buses.

5. Detail short-circuits current rating of enclosed switch or circuit breaker assembly and overcurrent protective devices.

6. Include descriptive documentation of barriers specified for electrical insulation and isolation.

7. Include schematic and wiring diagrams for power, signal, and control wiring.

8. Include nameplate legends.

9. Include list of materials.

D. Coordination Drawings: Floor plans showing dimensioned layout, required working clearances, and required area above and around enclosed switches and circuit breakers where pipe and ducts are prohibited. Show enclosed switch and circuit breaker layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.

E. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.

1. Certificate of compliance.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

F. Field quality-control reports.

1. Test procedures used.

2. Test results that comply with requirements.

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

G. Sample Warranty: For warranty.

H. Project Record Documents: Record actual installed equipment and circuiting arrangements. Record actual routing for underground circuits. Record actual installed location of ground rods.

I. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Routine maintenance requirements for enclosed switches, circuit breakers and all installed components.

2. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

3. Time-current curves; include selectable ranges for each type of overcurrent protective device.

4. Features and operating sequences, both automatic and manual.

5. Video recording of operation training and demonstration.

J. Follow-up service reports.

1.5 QUALITY ASSURANCE

A. Test Equipment Suitability and Calibration: Comply with NETA ATS, "Suitability of Test Equipment" and "Test Instrument Calibration."

B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

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

D. Comply with NFPA 70.

1.6 PROJECT CONDITIONS

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

B. Environmental Limitations:

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

2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).

b. Altitude: Not exceeding 6600 feet (2010 m).

C. Interruption of Existing Electric Service: Refer to Division 26 section “General Electrical Requirements”

1.7 DELIVERY, STORAGE, AND HANDLING

A. Coordinate delivery of equipment to allow movement into designated space.

B. Store in a clean, dry space, protected from weather and so condensation will not form on or in units. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic. Handle carefully in accordance with manufacturer's instructions to avoid damage to equipment

components, enclosure, and finish. Provide temporary heating according to manufacturer's written instructions.

C. Handle and prepare enclosed switches and circuit breakers components according to manufacturer's written instructions. Use factory-installed lifting provisions.

1.8 WARRANTY

A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components and/or products of the enclosed switches and circuit breakers that fail in materials or workmanship within the specified warranty period.

B. Warranty Period: Three years from date of Substantial Completion.

1.9 SEISMIC REQUIREMENTS

A. Seismic bracing, restraints, and controls for all electrical systems specified herein shall be designed and installed as required by Division 26 Section "Seismic Controls for Electrical Systems" and Division 20 Section "Seismic Controls for MEP/F/T Systems".

1.10 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Primary Switch Contact Lubricant: One container.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

A. Manufacturers:

1. ABB Inc.
2. Eaton.
3. Schneider Electric.
4. Siemens Energy & Automation, Inc.

B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Short Circuit Current Rating: 100,000 rms symmetrical amps when fuses applied.

D. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.

3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.

4. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.2 NONFUSIBLE SWITCHES

A. Manufacturers:

1. ABB Inc.

2. Eaton.

3. Schneider Electric.

4. Siemens Energy & Automation, Inc.

B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.

2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.

3. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.3 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.

2. Outdoor Locations: NEMA 250, Type 3R.

2.4 IDENTIFICATION

A. Nameplates: Nameplates and label products are specified in Division 26 Section "Identification for Electrical Systems."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine enclosed switches and circuit breakers before installation. Reject equipment that is damaged, or rusted, or have been subjected to water saturation.

B. Examine areas, surfaces, substrates, and elements to receive enclosed switches and circuit breakers with Installer present, for compliance with requirements for installation tolerances, structural support, ventilation, temperature, humidity, and other conditions affecting performance of the Work.

1. Verify that field measurements are as indicated.

2. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment will be installed, before installation begins.

C. Examine roughing-in of conduits and grounding systems to verify the following:

1. Wiring entries comply with layout requirements.

2. Entries are within conduit-entry tolerances specified by manufacturer and no feeders will have to cross section barriers to reach load or line lugs.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install enclosed switches and circuit breakers and accessories in accordance with manufacturer’s instructions.

B. Coordinate layout and installation of equipment with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

C. Comply with mounting and anchoring requirements specified in Division 26 Section "Seismic Controls for Electrical Systems."

D. Wall-Mounted Switches and Circuit Breakers: Install enclosed switches and circuit breakers on walls with tops at uniform height unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For enclosed switches and circuit breakers not at walls, provide freestanding racks complying with Division 26 Section "Hangers and Supports for Electrical Systems."

E. Mount equipment plumb and rigid without distortion of enclosure.

F. Install fuses in fusible devices.

G. Comply with NECA 1.

3.3 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools for control wiring.

3.4 IDENTIFICATION

A. Equipment Nameplates: Label each section with equipment nameplate.

B. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Identification for Electrical Systems."

3.5 CLEANING

A. After completing equipment installation and before energizing, inspect unit components. Vacuum dirt and debris from interior of equipment; do not use compressed air to assist in cleaning. Remove paint splatters and other spots. Repair exposed surfaces to match original finish.

3.6 ADJUSTING

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

3.7 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control tests and inspections:

B. Acceptance Testing Preparation:

1. After installing equipment but before equipment is energized, test for compliance with requirements.
2. Verify that grounding system at the equipment tested at the specified value or less.
3. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
4. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters. After electrical circuitry has been energized, test for compliance with requirements.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
4. Report results of tests and inspections in writing. Record adjustable settings and measured insulation resistances. Attach a label or tag to each tested component indicating satisfactory completion of tests.

D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 262816

SECTION 263213 - PACKAGED ENGINE-DRIVEN GENERATORS

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. Diesel-engine generator sets for emergency power supply with the following features and accessories:

1. Engine-generator set.
2. Battery charger.
3. Starting battery
4. Day tank.
5. Muffler/silencer.
6. Generator overcurrent and fault protection.
7. Outdoor enclosure.
8. Vibration isolation devices.
9. Remote annunciator.
10. Unit-mounted cooling system.
11. Unit-mounted control and monitoring.
12. Remote emergency-stop switch.

1.2 DEFINITIONS

A. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

B. Steady-State Voltage Modulation: The uniform cyclical variation of voltage within the operational bandwidth, expressed in Hertz or cycles per second.

C. EPS: Emergency power supply.

D. EPSS: Emergency power supply system.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordinate layout and installation of generators and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.4 SUBMITTALS

A. Product Data: Include the following:

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

2. Thermal damage curve for generator.

3. Time-current characteristic curves for generator protective device.

B. Shop Drawings: Include the following:

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Dimensioned plan and elevation drawings of engine-generator set and other components specified.

3. Design Calculations: Signed and sealed by a qualified professional engineer. Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.

4. Base Attachment Details: Signed and sealed by a qualified professional engineer. Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include base weights.

5. Diagrams for power, signal, and control wiring. Complete schematic, wiring, and interconnection diagrams showing terminal markings for engine generators and functional relationship between all electrical components.

C. Coordination Drawings: For each equipment room and equipment yard, provide dimensioned layout of the electrical equipment within the space, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved.

1. Dimensioned concrete base, outline of equipment, conduit entries, and ground rod locations; including equipment working clearances and manufacturer required access space.

2. Location of structural supports for structure-supported raceways, piping, and seismic bracing.

3. Location and clearance of electrical equipment and raceways impacting equipment installation.

D. Seismic Qualification Data: Certificates, for engine generator, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: With engine and generator mounted on rails, identify center of gravity and total weight, including supplied

enclosure, external silencer, and each piece of equipment not integral to the engine generator, and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Qualification Data:

1. For Installer.

2. For manufacturer.

3. For testing agency.

F. Source Quality-Control Reports: Including, but not limited to, the following

1. Certified summary of prototype-unit test report.

2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.

3. Certified Summary of Performance Tests: Certify compliance with specified requirement to meet performance criteria.

4. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.

5. Report of exhaust emissions showing compliance with applicable regulations.

6. Certification of Torsional Vibration Compatibility: Comply with NFPA 110.

G. Field quality-control test reports.

H. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

a. List of tools and replacement items recommended to be stored at the Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.

b. Operating instructions laminated and mounted adjacent to generator location.

c. Training plan.

I. Warranty

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 200 miles (160 km) of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.

C. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

D. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer. Source shall be responsible for insuring all components of system proved under this specification section, and controlled equipment within the following sections, operate together to meet project requirements including, but not limited to controls, monitoring, and selective coordination.

1. 262413 Switchboards

2. 263600 Transfer Switches

E. Product Options: Drawings indicate size, profiles, and dimensional requirements of packaged generator sets and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

F. Product Selection for Restricted Space: Drawings indicate maximum dimensions for generators including clearances between generators and adjacent surfaces and other items. Comply with indicated maximum dimensions.

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

H. Comply with NFPA 30

I. Comply with NFPA 37.

J. Comply with NFPA 70.

K. Comply with NFPA 110 requirements for Level 1, Type 10, Class “X” emergency power supply system.

L. Engine Exhaust Emissions: Comply with applicable state and local government requirements.

1.6 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.7 WARRANTY

A. Manufacturer’s Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

1.8 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include quarterly exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Maintenance agreements shall include parts and supplies as used in manufacture and installation of original equipment.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: One for every 10 of each type and rating, but not less than one of each.
2. Filament Type Indicator Lamps: Two for every six of each type used, but not less than two of each.
3. Filters: One set each of lubricating oil, fuel, and combustion-air filters.

PART 2 - PRODUCTS AND MATERIALS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Cummins Power Generaton 750KW Generator or comparable products by one of the following, the manufacturer used as the basis of design is listed in schedule:

1. Caterpillar; Engine Div.
2. MTU Onsite Energy
3. Rehlko (Formerly Kohler Power Systems)
4. Blue Star Power Systems

2.2 SERVICE CONDITIONS

A. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: Minus 15 to plus 40 deg C.
2. Relative Humidity: 0 to 95 percent.
3. Altitude: Sea level to 1000 feet (300 m).

2.3 ENGINE GENERATOR ASSEMBLY DESCRIPTION

A. Factory-assembled and -tested, water-cooled engine, with brushless generator and accessories.

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

C. Power Rating: Standby.

D. Service Load: Generator system shall be sized to replace existing generator, but shall not be less than 750 kW.

E. Power Factor: 0.8, lagging.

F. Frequency: 60 Hz.

G. Voltage: 480 V AC.

H. Phase: Three-phase, four wire, wye.

I. Governor: Adjustable isochronous, with speed sensing.

J. Seismic Performance: Engine generator housing, engine generator, batteries, battery racks, silencers, accessories, and components shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

K. Mounting Frame: Adequate strength and rigidity to maintain alignment of mounted components without depending on concrete foundation. Mounting frame shall be free from sharp edges and corners and shall have lifting attachments arranged for lifting with slings without damaging components.

1. Rigging Diagram: Inscribed on metal plate or other durable material permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.

L. Capacities and Characteristics:

1. Power Output Ratings: Nominal ratings as indicated at 0.8 power factor excluding power required for the continued and repeated operation of the unit and auxiliaries, with capacity as required to operate as a unit as evidenced by records of prototype testing.

2. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.

M. Generator-Set Performance

1. Steady-State Voltage Operational Bandwidth: 1 percent of rated output voltage from no load to full load.

2. Transient Voltage Performance: Refer to Generator Sizing Schedule on drawings. Voltage shall recover and remain within the steady-state operating band within three seconds.

3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.

4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.

5. Transient Frequency Performance: Frequency shall recover and remain within the steady-state operating band within five seconds.

6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. The telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.

7. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, the system shall supply a minimum of 300 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.

8. Start Time: Comply with NFPA 110, Type 10, system requirements.

2.4 ENGINE

A. Fuel: ASTM D975 #2 Diesel Fuel.

B. Rated Engine Speed: 1800 rpm.

C. Lubrication System: The following items are mounted on engine or skid:

1. Lube Oil Pump: Positive displacement, mechanical, full pressure pump.

2. Filter and Strainer: Provided by engine manufacturer rated to provide manufacturers recommended filtration levels and flow for prime mover used.

3. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.

4. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

D. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity.

E. Integral Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine generator mounting frame and integral engine-driven coolant pump.

1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.

2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.

3. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.

4. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.

a. Rating: 50-psig (345-kPa) maximum working pressure with coolant at 180 deg F (82 deg C), and noncollapsible under vacuum.

b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

F. Muffler/Silencer

1. Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.

    a. Minimum sound attenuation of 25 dB at 500Hz.

    b. Sound level measured at a distance of 10 feet (3 m) from exhaust discharge shall be 85 dBA or less.

G. Air-Intake Filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

H. Starting System: 24-V electric, with negative ground.

1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in "Environmental Conditions" Paragraph in "Service Conditions" Article.

2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.

3. Cranking Cycle: As required by NFPA 110 for system level specified.

4. Battery: Adequate capacity within ambient temperature range specified in "Environmental Conditions" Paragraph in "Service Conditions" Article to provide specified cranking cycle at least twice without recharging.

5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.

6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater shall be arranged to maintain battery above 10 deg C regardless of external ambient temperature within range specified in "Environmental Conditions" Paragraph in "Service Conditions" Article. Include accessories required to support and fasten batteries in place.

7. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.

8. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit shall comply with UL 1236 and include the following features:

    a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.

    b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.

    c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.

    d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.

e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.

f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

I. Installation of equipment required for emissions compliance shall include a complete manufacturer certified system, including, but not limited to any additional piping, heating and structural support.

2.5 FUEL SUPPLY SYSTEM

A. Diesel Fuel-Oil System

1. Comply with NFPA 37.

2. Main Fuel Pump: Mounted on engine to provide primary fuel flow under starting and load conditions.

3. Fuel Filtering: Provided by engine manufacturer rated to provide manufacturers recommended filtration levels and flow for prime mover.

4. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.

5. Day Tank: Comply with UL 142, freestanding, factory-fabricated fuel tank assembly, with integral, float-controlled transfer pump and the following features:

a. Containment: Integral rupture basin with a capacity of 150 percent of nominal capacity of day tank.

1) Leak Detector: Locate in rupture basin and connect to provide audible and visual alarm in the event of day-tank leak.

b. Tank Capacity: As recommended by engine manufacturer for an uninterrupted period of 2 hours' operation at 100 percent of rated power output of engine generator system without being refilled.

c. Pump Capacity: Exceeds maximum flow of fuel drawn by engine-mounted fuel supply pump at 110 percent of rated capacity, including fuel returned from engine.

d. Low-Level Alarm Sensor: Liquid-level device operates alarm contacts at 25 percent of normal fuel level.

e. High-Level Alarm Sensor: Liquid-level device operates alarm and redundant fuel shutoff contacts at midpoint between overflow level and 100 percent of normal fuel level.

f. Piping Connections: Factory-installed fuel supply and return lines from tank to engine; local fuel fill, vent line, overflow line; and tank drain line with shutoff valve.

g. Redundant High-Level Fuel Shutoff: Actuated by high-level alarm sensor in day tank to operate a separate motor device that disconnects day-tank pump motor. Sensor shall signal solenoid valve, located in fuel suction line between fuel storage tank and day tank, to close. Both actions shall

remain in shutoff state until manually reset. Shutoff action shall initiate an alarm signal to control panel but shall not shut down engine-generator set.

2.6 CONTROL AND MONITORING

A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of the generator set. When mode-selector switch is switched to the on position, the generator set starts. The off position of the same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down the generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down the generator set.

B. Configuration:

1. Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the generator set. Mounting method shall isolate the control panel from generator-set vibration. Panel shall be powered from the engine generator battery.

C. Control and Monitoring Panel:

1. Digital controller with integrated LCD, controls, and microprocessor, capable of local and remote control, monitoring, and programming, with battery backup.
2. Instruments: Located on the control and monitoring panel and viewable during operation.
    a. Engine lubricating-oil pressure gage.
    b. DC voltmeter (alternator battery charging).
    c. Engine-coolant temperature gage.
    d. Running-time meter.
    e. AC voltmeter
    f. AC ammeter
    g. AC frequency meter.
3. Controls and Protective Devices: Controls, shutdown devices, and common visual alarm indication, including the following:
    a. Cranking control equipment.
    b. Run-Off-Auto switch.
    c. Control switch not in automatic position alarm.
    d. Overcrank alarm.
    e. Overcrank shutdown device.
    f. Low water temperature alarm.
    g. High engine temperature prealarm.
    h. High engine temperature.

i. High engine temperature shutdown device.

j. Low lub oil pressure alarm

k. Low lub oil pressure shutdown

l. Overspeed alarm.

m. Overspeed shutdown device.

n. Low fuel main tank.

o. Coolant low-level alarm.

p. Coolant low-level shutdown device.

q. EPS load indicator.

r. Battery high-voltage alarm.

s. Low cranking voltage alarm.

t. Battery low-voltage alarm.

u. Contacts for local and remote common alarm.

v. Lamp test.

w. Coolant high-temperature prealarm.

x. Coolant high-temperature alarm.

y. Coolant low-temperature alarm.

z. Coolant high-temperature shutdown device.

aa. Hours of operation.

bb. Engine generator metering, including voltage, current, Hz, kW, kVA, and power factor.

cc. Remote manual stop shutdown device.

dd. Air shutdown damper alarm when used.

ee. Air shutdown damper shutdown device when used.

ff. Generator overcurrent protective device not closed alarm.

gg. Fuel tank derangement alarm.

hh. Fuel tank high-level shutdown of fuel supply alarm.

D. Connection to Power Monitoring and Control System: Reserved Modbus RTU/RS485 output from control system for transmission of alarm and status indications to remote terminals.

E. Remote Alarm Annunciator: An LED indicator light labeled with proper alarm conditions shall identify each alarm event, and a common audible signal shall sound for each alarm condition. Silencing switch in face of panel shall silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated.

1. Overcrank alarm.

2. Coolant low-temperature alarm.

3. High engine temperature prealarm.
4. High engine temperature alarm.
5. Low lube oil pressure alarm.
6. Overspeed alarm.
7. Low fuel main tank alarm.
8. Low coolant level alarm.
9. Low cranking voltage alarm.
10. Contacts for local and remote common alarm.
11. Audible-alarm silencing switch.
12. Air shutdown damper when used.
13. Run-Off-Auto switch.
14. Control switch not in automatic position alarm.
15. Low cranking voltage alarm.

F. Remote Emergency-Stop Switch: Flush; wall mounted, unless otherwise indicated; and labeled. Push button shall be protected from accidental operation.

G. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.

2.7 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Overcurrent protective devices shall be coordinated to optimize selective tripping when a short circuit occurs.

B. Generator Overcurrent Protective Device:

1. Generator Circuit Breaker: Molded-case, electronic-trip type; 100 percent rated; complying with UL 489.
    a. Tripping Characteristics: Adjustable long-time and short-time delay and instantaneous.
    b. Trip Settings: Matched to generator thermal damage curve as closely as possible.
    c. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
    d. Mounting: Adjacent to or integrated with control and monitoring panel.
2. Generator Disconnect Switch: Molded-case type, 100 percent rated.
    a. Rating: Matched to generator output rating.
    b. Shunt Trip: Connected to trip switch when signaled by generator protector or by other protective devices.

C. Generator Protector: Microprocessor-based unit shall continuously monitor current level in each phase of generator output, integrate generator heating effect over time, and predict

when thermal damage of the alternator will occur. When signaled by the protector or other generator-set protective devices, a shunt-trip device in the generator disconnect switch shall open the switch to disconnect the generator from the load circuits. Protector shall perform the following functions:

1. Initiates a generator overload alarm when the generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other generator-set malfunction alarms. Contacts shall be available for load shed functions.
2. Under single or three-phase fault conditions, regulates the generator to 300 percent of rated full-load current for up to 10 seconds.
3. As the overcurrent heating effect on the generator approaches the thermal damage point of the unit, the protector switches the excitation system off, opens the generator disconnect device, and shuts down the engine generator.
4. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot.

D. Ground-Fault Indication: Comply with NFPA 70, "Emergency System" signals for ground fault.

1. Indicate ground fault with other engine generator alarm indications.

2.8 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1 and specified performance requirements.

B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.

C. Electrical Insulation: Class H.

D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.

E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.

F. Excitation shall use Permanent Magnet Generator (PMG) arranged to sustain output under short-circuit conditions as specified.

G. Enclosure: Dripproof.

H. Instrument Transformers: Mounted within generator enclosure.

I. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.

J. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

K. Subtransient Reactance: 12 percent, maximum.

2.9 OUTDOOR GENERATOR-SET ENCLOSURE

A. Description:

1. Vandal-resistant weatherproof steel housing. Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panels shall be removable by one person without tools. Instruments,control, and battery system shall be mounted within enclosure.

B. Construction:

1. Structural Design and Anchorage: Comply with ASCE/SEI 7 for wind loads up to 150 mph (240 km/h).
2. Seismic Design: Comply with seismic requirements in Division 26 "Seismic Controls for Electrical Systems."
3. Louvers: Equipped with bird screen and filter arranged to permit air circulation when engine is not running while excluding exterior dust, birds, and rodents.
4. Hinged Doors: With padlocking provisions.
5. Space Heater: Thermostatically controlled and sized to prevent condensation.
6. Ventilation: Louvers equipped with bird screen and filter arranged to permit air circulation while excluding exterior dust, birds, and rodents.
7. Thermal Insulation: Manufacturer's standard materials and thickness selected in coordination with space heater to maintain winter interior temperature within operating limits required by engine-generator-set components.

C. Muffler Location: Within enclosure.

D. Engine Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for 2 hours with ambient temperature at top of range specified in system service conditions.

1. Louvers: Fixed-engine cooling-air inlet and discharge. Storm-proof and drainable louvers prevent entry of rain and snow.
    a. Automatic Dampers: At engine cooling-air inlet and discharge. Dampers shall be closed to reduce enclosure heat loss in cold weather when unit is not operating.

E. Interior Lights with Switch: Factory-wired, vaporproof-type fixtures within housing; arranged to illuminate controls and accessible interior. Arrange for external electrical connection.

F. Convenience Outlets: Factory-wired, GFCI. Arrange for external electrical connection.

2.10 VIBRATION ISOLATION DEVICES

A. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch-(6-mm-) thick, elastomeric isolator pad attached to baseplate underside; and

adjustable equipment-mounting and -leveling bolt that acts as blocking during installation.

2. Outside Spring Diameter: Not less than 80 percent of compressed height of the spring at rated load.

3. Minimum Additional Travel: 50 percent of required deflection at rated load.

4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

6. Finishes: Baked enamel for metal components on isolators for interior use. Hot-dip galvanized for metal components on isolators for exterior use.

2.11 FINISHES

A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard enamel over corrosion-resistant pretreatment and compatible standard primer.

2.12 SOURCE QUALITY CONTROL

A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.

1. Tests:

   a. Comply with IEEE 115.

   b. Comply with NFPA 110, Level 1 energy converters.

2. Components and Accessories: Items furnished with installed unit that are not identical to those on tested prototype shall have been factory tested to demonstrate compatibility and reliability.

B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:

1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.

2. Test generator, exciter, and voltage regulator as a unit.

3. Full load run.

4. Maximum power.

5. Voltage regulation.

6. Transient and steady-state governing.

7. Single-step load pickup.

8. Safety shutdown.

C. Report factory test results within 10 days of completion of test.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine-generator performance.

B. Examine roughing-in of piping systems and electrical connections. Verify actual locations of connections before packaged engine-generator installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.

1. For installations where field-deployed after treatment equipment is utilized, install equipment in accordance with manufacturer’s requirements to ensure the final installation meets the manufacturer’s definition of a factory-certified arrangement.

B. Equipment Mounting:

1. Install packaged engine generators on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."

2. Coordinate size and location of concrete bases for packaged engine generators and fuel day tanks mounted on grade. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

3. Install packaged engine generator with restrained spring isolators having a minimum deflection of 1 inch (25 mm) on 4-inch- (100-mm-) high concrete base. Secure to anchor bolts installed in concrete base.

C. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.3 CONNECTIONS

A. Piping installation requirements are specified in Division 23 Sections. Drawings indicate general arrangement of piping and specialties. The following are specific connection requirements:

1. Install fuel piping adjacent to packaged engine generator to allow service and maintenance.

2. Connect fuel piping to engines with a gate valve and union.

a. Diesel fuel piping, valves, and specialties inside the building are specified in Division 23 Section "Fuel Oil Piping."

3. Connect exhaust-system piping to engines.

B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Division 26 Section " Low-Voltage Electrical Power Conductors and Cables ."

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

3.4 IDENTIFICATION

A. Identify system components according to Division 23 Section "Identification for HVAC piping and Equipment" and Division 26 Section "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Perform tests recommended by manufacturer and each visual and mechanical inspection and electrical and mechanical test listed in first two subparagraphs below, as specified in NETA ATS. Certify compliance with test parameters.

a. Visual and Mechanical Inspection:

1) Compare equipment nameplate data with Drawings and the Specifications.

2) Inspect physical and mechanical condition.

3) Inspect anchorage, alignment, and grounding.

4) Verify that the unit is clean.

b. Electrical and Mechanical Tests:

1) Perform insulation-resistance tests according to IEEE 43.

a) Machines Larger Than 200 hp (150 kW): Test duration shall be 10 minutes. Calculate polarization index.

b) Machines 200 hp (150 kW) or Less: Test duration shall be one minute. Calculate the dielectric-absorption ratio.

2) Test protective relay devices.

3) Verify phase rotation, phasing, and synchronized operation as required by the application.

4) Functionally test engine shutdown for low oil pressure, overtemperature, overspeed, and other protection features as applicable.

5) Verify correct functioning of the governor and regulator.

2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here, including, but not limited to, single-step full-load pickup test.

3. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.

4. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.

5. Exhaust Emissions Test: Comply with applicable government test criteria.

6. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.

7. Harmonic-Content Tests: Measure harmonic content of output voltage at 25 percent and at 100 percent of rated linear load. Verify that harmonic content is within specified limits.

B. Coordinate tests with tests for transfer switches and run them concurrently.

C. Test instruments shall have been calibrated within the last 12 months, traceable to standards of the National Institute for Standards and Technology, and adequate for making positive observation of test results. Make calibration records available for examination on request.

D. Leak Test: After installation, charge exhaust, coolant, and fuel systems and test for leaks. Repair leaks and retest until no leaks exist.

E. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation for generator and associated equipment.

F. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

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

H. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

I. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

3.6 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.

C. Complete installation and startup checks according to manufacturer's written instructions.

D. Installing contractor shall provide sufficient fuel for testing, commissioning and start up, and turn the generator over to the owner with a full tank upon the Owner’s acceptance of the completed generator and standby/emergency power distribution systems.

E. For installations that utilize a Diesel Exhaust Fluid (DEF) or other type of urea dosing system as part of the field-deployed after-treatment, Provide sufficient DEF for testing, commissioning and start up, and turn the generator over to the owner with a full tank upon the Owner’s acceptance of the completed generator and standby/emergency power distribution systems.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators.

1. Coordinate this training with that for transfer switches..

END OF SECTION 263213

SECTION 263215 - GENERATOR TERMINATION CABINETS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This section specifies the furnishing, installation, and connection of a low-voltage temporary generator quick connection panel, indicated as “Termination Cabinet” in this section.

B. Generator Quick Connection Termination Cabinet shall allow quick and safe connection of a mobile generator set to facilities experiencing loss of power.

1.2 QUALITY ASSURANCE

A. Manufacturer Qualifications: The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. Maintain a service center of factory trained personnel who must be on call 24 hours a day, 365 days a year.

B. Perform factory and installation tests in accordance with applicable NEC requirements.

C. Tap Box shall conform to the dielectric (HI POT) test from UL891.

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

E. Comply with NFPA 70.

F. Comply with NFPA 110.

G. Comply with UL 1008.

1.3 REFERENCE STANDARDS

A. Publications listed below (including amendments, addenda, revisions, supplements and errata) were referenced to form parts of this specification.

B. National Electrical Manufacturer's Association (NEMA):

C. NEMA PB-2.1-07 - Proper Handling, Installation, Operation, and Maintenance of Dead-front Distribution Switchboards Rated 600 Volts or Less

D. National Fire Protection Association (NFPA):

1. 70-11 National Electrical Code (NEC)

E. Underwriters Laboratories, Inc. (UL):

1. 50 Standard for Enclosures for Electrical Equipment
2. 891 Switchboards
3. 1008 Supplement SB Standard Requirements for Inlet Assemblies for Transfer Switch Equipment

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's printed product data. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Include components, materials, finishes, detailed plan and elevation views, cam type openings, conductor entry provisions, gutter space, and minimum clearances.

C. Factory test reports.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For each type of product to include in emergency, operation,

F. and maintenance manuals. In addition to items specified in Division 01 Section "Operation and

G. Maintenance Data," include the following:

1. Features and operating sequences.
2. Instructional leaflets and bulletins.
3. Contact information for factory service center.
4. Renewal parts list where applicable.

1.5 SEISMIC REQUIREMENTS

A. Seismic bracing, restraints, and controls for all electrical systems specified herein shall be designed and installed as required by Division 26 Section “Seismic Controls for Electrical Systems” and Division 20 Section “Seismic Controls for MEP Systems”.

1.6 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in division 03.

1.7 WARRANTY

A. Special warranty: manufacturer’s standard form in which manufacturer agrees to repair or replace components of the connection cabinet that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL

A. Size and electrical characteristics shall be as noted on the Drawings.

B. Termination Cabinet shall have the following features:

1. Termination Cabinet shall be a complete, grounded, continuous-duty, integral assembly, dead-front, outdoor type Termination Cabinet assembly. Incorporate devices shown on the drawings and all related components required to fulfill operational and functional requirements.

2. Termination Cabinet shall be supplied as a complete system and shall include all the necessary components and equipment to accommodate described system operation unless otherwise noted.

3. Termination Cabinet shall conform to the arrangements and details shown on the drawings.

4. Termination Cabinet shall be assembled, connected, and wired at the factory so that only external circuit connections are required at the construction site.

5. All non-current-carrying metallic parts shall be grounded.

C. Configuration: Cabinet shall incorporate a multiple chamber style design to isolate permanent connections and camlock connections. Temporary Cables shall enter and exit the wiring chamber via access holes specifically designed for conductors and shall be provided with a bushing or shall be formed so that there are no sharp edges with which conductor insulation may come in contact. Temporary wiring provisions shall be arranged so that cables drape downward when connected.

D. Factory Wiring: All cable/control wire shall be copper. Train and bundle factory wiring and label, consistent with Shop Drawings, either by color-code or by numbered or lettered wire and cable tape markers at terminations. All factory wiring shall be accessible from the equipment front. Color-coding and wire and cable tape markers are specified in Division 26 Section "Identification for Electrical Systems."

1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.

2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for bottom entrance of temporary feeder conductors. Power terminals shall be rated for 90 degree C and copper or aluminum cable.

3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.

4. Cable Entry: Cable entry shall be from the back.

2.2 MANUFACTURER

A. Basis-of-Design Product: Subject to compliance with requirements, provide comparable products by one of the following, the first listed manufacturer was used as the basis of design:

1. Trystar of Faribault, MN.

2. Advanced Power Technologies (APT)

3. Square D

4. Eaton

5. ESL Power Systems Inc

6. Siemens

7. GE

2.3 HOUSING

A. Enclosure:

1. Enclosure shall be outdoor NEMA 3R manufactured from code gauge Steel.
2. Steel support frame rigidly bolted to support cover sheets, bus bars and installed devices during shipment and installation.
3. Front-Connected with fully self-supporting individual sections bolted together to form required arrangement both front and rear aligned.
4. 3. All sections may be rolled, moved or lifted into position. Enclosure shall be capable of being bolted directly to the floor without the use of floor sills.
5. The enclosure shall include a front pad lockable door with concealed hinges and a hinged integral lower flip open door to allow cable connection of the temporary generator.
6. The lower flip door shall be mechanically interlocked with the main front door for personnel protection when the connection panel is not in use.
7. Temporary generator cables shall only be able to be connected through the lower flip door.
8. Individually mounted device compartments and generator connection compartment with interior doors. Interior and exterior door configuration shall allow for NEMA 3R enclosure integrity to be maintained while temporary cabling is connected during use.
9. Stainless Steel exterior hardware shall be utilized.
10. Ventilation openings shall be provided complete with replaceable fiber glass air filters.
11. For ease of the Termination Cabinet service, maintenance and future upgrades, all the support structures, braces and cover sheets for the circuit breakers, main bus, neutral bus, and ground bus shall be removable and attached via bolts.

B. Finish:

1. One (1) powder coat of ANSI 61 Light Gray shall be applied to all interior and exterior surfaces.
2. The final finish must be exterior rated for NEMA 3R use.

2.4 BUSSING

A. Silver plated copper busbar shall be used for “permanent” cable connections to the facility via the side or rear sheets of enclosure and shall be fully rated for the available short circuit rating up to an including 65kA at 480V.

B. Provide a full capacity neutral bus where a neutral bus is indicated on the drawings.

C. A copper ground bus shall be furnished firmly secured and bonded to each vertical section structure.

D. All hardware used on conductors shall be high-tensile strength and zinc-plated. All bus joints shall be provided with conical spring-type washers.

2.5 LUGS

A. Permanent facility side (Load) connections shall connect to busbar via mechanical lugs, suitable for use with conductor material and sizes, and located behind a physical barrier.

1. Material: Same as bus material.

2. Capacity rating: Same as associated bus..

2.6 'CAM-LOK' TYPE CONNECTORS

A. 'Cam-Lok' type connectors shall be NEMA 3R rated to be used in direct rain should the door become open.

B. Each color-coded, male 'Cam-Lok' compatible single pole receptacle with cover shall be color coded as follows:

Phase	208Y/120V	480Y/277V
A	Black	Brown
B	Red	Orange
C	Blue	Yellow
Neutral	White	Gray**
Equipment Ground	Green	Green

2.7 ACCESSORY COMPONENTS

A. Additional accessories shall be included in submittal drawing as follows:

1. Auto Start Terminals

2. Phase Rotation Monitor

3. Battery Charger Receptacle 20A GFCI 125V

4. Block Heater Receptacle 30A L5-30 125V

5. Strip Heater & Thermostat

B. Signal connections: Wiring, fuse blocks, and terminal blocks within the cabinet shall be furnished as required. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer's wiring diagrams.

C. Instructional signage shall be provided which describes the sequence of operation for connection of a mobile generator.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install Termination Cabinet in accordance with the NEC, as shown on the drawings, and as recommended by the manufacturer.

B. Floor/ground mounted termination cabinets shall be mounted on a Concrete Base.

1. Concrete Bases: 4 inches (100 mm) high, reinforced, with chamfered edges. Extend base no more than 4 inches (100 mm) in all directions beyond the maximum dimensions of cabinet, unless otherwise indicated or unless required for

seismic support. Construct concrete bases according to Division 26 Section "Hangers and Supports for Electrical Systems.

C. Provide clear, detailed, written instructions permanently attached to the inner face of the main door for staff reference.

D. Set field-adjustable intervals and delays.

3.2 CONNECTIONS

A. Wiring to Remote Components: Match type and number of cables for control and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.

B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables.

3.3 IDENTIFICATION

A. Label products as specified in Division 26 Section "Identification for Electrical Systems".

B. Equipment Nameplates: Label each cabinet with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

1. Each Termination Cabinet shall have a label permanently affixed to it, listing the following information: Name of manufacturer, system voltage, ampacity, and type.
2. Each phase indicating nameplate shall be black lettering on the appropriate phase color background.
3. A nameplate shall identify each component mounted inside the panel.

C. Field-installed wiring and components: Identify as specified in Division 26 Sections “Low Voltage Electrical Power Conductors and Cables” and "Identification for Electrical Systems."

D. Operating Instructions: Provide Instruction Signs complying with requirements for identification specified in Division 26 "Identification for Electrical Systems." Include instruction for key interlocking, control sequences, elementary single-line diagram, and emergency procedures. Mount on front of cabinet.

3.4 CLEANING

A. After completing equipment installation and before energizing, inspect unit components. Vacuum dirt and debris from interior of equipment; do not use compressed air to assist in cleaning. Remove paint splatters and other spots. Repair exposed surfaces to match original finish.

3.5 ADJUSTING

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

B. Set field-adjustable circuit-breaker trip ranges as specified in Division 26 Section "Power System Studies."

3.6 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control tests and inspections:

B. Tests and Inspections:

1. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
3. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
    a. Check for electrical continuity of circuits and for short circuits.
    b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
4. Verify that instructional signage and warning labels are properly placed.
5. Perform mobile generator connection test.
6. Demonstrate interlocking sequence and operational function for each switch.
    a. With mobile generator connected simulate power failures of normal source to automatic transfer switches and of mobile source with normal source available.

C. Provide mobile generator for the duration connection box testing.

D. Report results of tests and inspections in writing. Record adjustable relay settings and measured

E. insulation and contact resistances and time delays.

3.7 TRAINING

A. Allow 4 hours of training for the Owner’s facility personnel. Instruction shall include the use, maintenance and safety requirements for the equipment.

END OF SECTION 263215

SECTION 263600 - TRANSFER SWITCHES

PART 1 - GENERAL REQUIREMENTS

1.1 SUMMARY

A. This section includes transfer switches rated 600 V and less, including the following:

1. Automatic transfer switches.
2. Bypass/isolation switches.
3. Remote annunciation systems.

1.2 DEFINITIONS

A. Open Transition (Break-Before-Make): A switch that is configured to break (open) the first set of contacts before engaging (closing) the new contacts. This prevents the momentary connection of the old and new circuit paths together.

B. Withstand duration: The withstand rating value is the level of fault current that must be withstood for a specified length of time, i.e., 42000 amps at 3 cycles.

C. Level 1 Equipment: Level 1 is the more stringent NFPA emergency life safety requirement and is imposed when failure of the emergency system, including the transfer equipment could result in loss of human life or serious injury.

D. NETA ATS: InterNational Electrical Testing Association Acceptance Testing Specification.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordinate layout and installation of switchboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Concrete, reinforcement, and formwork requirements are specified in Division 03.

C. Initial Fault-Current Study, Coordination Study, and Overcurrent Protective Device Settings report must be completed and submitted for review prior to final order, assembly or shipping of the electrical distribution system components. If studies have not been approved prior to shipping, assembly or final ordering of the electrical distribution system components, all changes to the equipment necessitated by the results of the study will be provided by the contractor at no additional cost to the project. Refer to specification section “Overcurrent Protective Device Coordination Study”

1.4 SUBMITTALS

A. Product Data: For each type of transfer switch, switching and overcurrent protective device, instrumentation, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each transfer switch and related equipment.

1. Include dimensioned plans, elevations, sections, and details, including required clearances, service space around equipment, and attachments to other work. Show tabulations of installed devices, equipment features, and ratings.

   a. Tabulate features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

2. Detail enclosure types and details for other than NEMA 250, Type 1.

3. Include general arrangement drawing showing dimensions and weights of each assembled section.

4. Detail bus configuration, current, and voltage ratings, including size and number of bus bars and current rating for each bus. Indicate mains and branches of phase, neutral, and ground buses. Show connections between transfer switch, bypass/isolation switch, power sources, and load; and show interlocking provisions for each combined transfer switch and bypass/isolation switch.

5. Detail short-circuit current rating of transfer switch assembly and overcurrent protective devices.

6. Include descriptive documentation of barriers specified for electrical insulation and isolation.

7. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

8. Include schematic and wiring diagrams for power, signal, and control wiring.

9. Include nameplate legends.

10. Include list of materials.

C. Coordination Drawings: Floor plans showing dimensioned layout, required working clearances, and required area above and around transfer switches where pipe and ducts are prohibited. Show transfer switch layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.

1. For each equipment room, provide dimensioned layout of the electrical equipment within the space, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved.

2. Dimensioned concrete base, outline of transfer switch, conduit entries, and ground rod locations; including equipment working clearances and manufacturer required access space.

3. Indicate structural members, light fixtures, sprinkler piping and heads, HVAC equipment, ducts and diffusers, plumbing piping and access fittings. Include maintenance access clearances.

4. Location of structural supports for structure-supported raceways and seismic bracing.

5. Location and clearance of electrical equipment and raceways impacting equipment installation.

D. Seismic Qualification Data: For panelboard equipment, accessories, and components, from manufacturer.

1. Certificate of compliance.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Qualification Data: For qualified manufacturer.

F. Factory test reports.

G. Field Quality-Control Reports:
1. Test procedures used.
2. Test results that comply with requirements.

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

I. Manufacturer's field service report.

J. Sample Warranty: For warranties.

K. Project Record Documents: Record actual installed equipment and circuiting arrangements. Record actual routing for underground circuits. Record actual installed location of ground rods.

L. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
1. Routine maintenance requirements for panelboards and all installed components.
2. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
3. Time-current curves; include selectable ranges for each type of overcurrent protective device. Provide relay-settings and calibration instructions, including software, where applicable.
4. Features and operating sequences, both automatic and manual.
5. Video recording of operation training and demonstration.

M. Follow-up service reports.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintain a service center capable of providing training, parts, and emergency maintenance repairs within a response period of less than eight hours from time of notification.

B. Source Limitations: Obtain automatic transfer switches bypass/isolation switches and remote annunciator panels through one source from a single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards including clearances between switchboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

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

E. Comply with NEMA ICS 1.

F. Comply with NFPA 70.

G. Comply with NFPA 99.

H. Comply with NFPA 110.

I. Comply with UL 1008 unless requirements of these Specifications are stricter.

1.6 PROJECT CONDITIONS

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

B. Environmental Limitations:

1. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a. Ambient Temperature: Not exceeding 23 deg F (minus 5 deg C) to plus 104 deg F (plus 40 deg C).

b. Altitude: Not exceeding 6600 feet (2000 m).

C. Interruption of Existing Electric Service: Do not interrupt electric service to occupied facilities. Refer to Division 26 Section “General Electrical Requirements” for allowable outages.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver transfer switches in sections or lengths that can be moved past obstructions in delivery path.

B. Coordinate delivery of equipment to allow movement into designated space.

C. Store in a clean, dry space, protected from weather and so condensation will not form on or in units. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic. Handle carefully in accordance with manufacturer's instructions to avoid damage to equipment components, enclosure, and finish. Provide temporary heating according to manufacturer's written instructions.

D. Handle and prepare transfer switch components according to manufacturer's written instructions. Use factory-installed lifting provisions.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of the Transfer Switch that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Damage from transient voltage surges.

B. Warranty Period: Cost to repair or replace any parts for two years from date of Substantial Completion.

C. Extended Warranty Period: Cost of replacement parts (materials only, f.o.b. the nearest shipping point to Project site), for eight years, that failed in service due to transient voltage surges.

1.9 SEISMIC REQUIREMENTS

A. Seismic bracing, restraints, and controls for all electrical systems specified herein shall be designed and installed as required by Division 26 Section "Seismic Controls for Electrical Systems" and Division 20 Section "Seismic Controls for MEP Systems".

1.10 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Indicating Lights: Four of each type installed.
2. Switching Contact Lubricant: One container.
3. Alarm Contacts: Equal to 10 percent of quantity supplied, but no fewer than two of each type.
4. Touchup Paint: Two containers of paint matching enclosure finish, each 0.5 pint (250 mL).
5. Enclosure Keys: Two for each enclosure type. All distribution equipment keyed alike.

PART 2 - PRODUCTS

2.1 GENERAL

A. Manufacturers:

1. Contactor Transfer Switches:

a. Caterpillar; Engine Div.

b. Eaton Electrical Inc.; Cutler-Hammer

c. Emerson; ASCO Power Technologies, LP.

d. GE Zenith Controls.

e. Rehlko (Formerly Kohler Power Systems).

f. Onan/Cummins Power Generation; Industrial Business Group.

g. Russelectric, Inc.

h. Spectrum Detroit Diesel.

B. Indicated Voltage and Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated. Voltage ratings shall be consistent with applications from 115 volts AC to 600 volts and single or three phase as required by the application. Current ratings and the number of poles shall be as indicated on the plans.

C. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.

1. Where the transfer switch internal fault-current protection can not exceed the indicated fault-current values, an enclosed fused switch with current limiting fuses shall be installed ahead of the transfer switch.

D. Controls: Microprocessor control having repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C. All internal controls components shall be accessible from the equipment front.

E. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

F. Electrical Operation: Accomplish by a non-fused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.

G. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.

1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are not acceptable.

2. Switch Action: Double throw; mechanically held in both directions.

3. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.

H. Neutral Switching: Where four-pole switches are indicated, provide overlapping neutral contacts

I. Neutral Terminal: Solid and fully rated bus bar, unless otherwise indicated.

J. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels shall have communication capability matched with remote device.

K. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, either by color-code or by numbered or lettered wire and cable tape markers at terminations. All factory wiring shall be accessible from the equipment front. Color-

coding and wire and cable tape markers are specified in Division 26 Section "Identification for Electrical Systems."

1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.

2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated. Power terminals shall be rated for 90 degree C and copper or aluminum cable.

3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.

L. Enclosures: General-purpose NEMA 250, Type 1, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

M. Bus and Wiring: All Bus and cable /control wire shall be copper.

N. Cable Entry: Cable entry shall be from the top.

2.2 AUTOMATIC TRANSFER SWITCHES

A. Comply with Level 1 equipment according to NFPA 110.

B. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.

C. Manual Switch Operation: Under load, with door closed and with either or both sources energized. Transfer time is same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.

D. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.

E. Digital Communication Interface: Matched to capability of remote annunciator or annunciator and control panel.

F. Automatic open-transition transfer switches: Include the following functions and characteristics:

1. Fully automatic break-before-make.

G. In-Phase Monitor: Factory-wired, internal relay controls transfer so it occurs only when the two sources are synchronized in phase. Relay compares phase relationship and frequency difference between normal and emergency sources and initiates transfer when both sources are within 15 electrical degrees, and only if transfer can be completed within 60 electrical degrees. Transfer is initiated only if both sources are within 2 Hz of nominal frequency and 70 percent or more of nominal voltage.

H. Programmed Neutral Switch Position: Switch operator has a programmed neutral position arranged to provide a midpoint between the two working switch positions, with an intentional, time-controlled pause at midpoint during transfer. Pause is adjustable from 0.5 to 30 seconds minimum and factory set for 0.5 second, unless otherwise indicated. Time delay occurs for both transfer directions. Pause is disabled unless both sources are live. The neutral shall not be stopped at mid point for any reason and shall transfer unimpeded from one position to the other.

I. Automatic Transfer-Switch Features:

1. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.

2. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.

3. Frequency: Monitor the frequency of the incoming normal power circuit. For the normal source, initiate transfer if the frequency varies more that 5% from the rated nominal value. For the emergency source, inhibit transfer if the normal source circuit frequency varies more that 5% from the rated nominal value.

4. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.

5. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.

6. Test Switch: Simulate normal-source failure.

7. Switch-Position Pilot Lights: Indicate source to which load is connected.

8. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.

   a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."

   b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."

9. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.

10. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.

11. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum. Time Delay, adjustable from 0 to 6 seconds, is included.

12. Mobile Generator Start Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum. Mimic permanent engine start contacts for connection of mobile generator terminal cabinet.

13. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.

14. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods

are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:

a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.

b. Push-button programming control with digital display of settings.

c. Integral battery operation of time switch when normal control power is not available.

2.3 BYPASS/ISOLATION SWITCHES

A. Comply with requirements for Level 1 equipment according to NFPA 110.

B. Description: Manual type, arranged to select and connect either source of power directly to load, isolating transfer switch from load and from both power sources. Bypass/Isolation switch shall have main contacts and operating mechanism similar to the Automatic Transfer Switch except all operations shall be manual. Include the following features for each combined automatic transfer switch and bypass/isolation switch:

1. Means to lock bypass/isolation switch in the position that isolates transfer switch with an arrangement that permits complete electrical testing of transfer switch while isolated. While isolated, interlocks prevent transfer-switch operation, except for testing or maintenance.

2. Drawout Arrangement for Transfer Switch: The isolating portion of the isolation/bypass switch shall provide physical separation from all live parts (power and control) to provide accessibility for testing and maintenance operations of the transfer switch.

3. Bypass/Isolation Switch Configuration, Current, Voltage, Closing, and Short-Circuit Withstand Ratings: Equal to or greater than those of associated automatic transfer switch, and with same phase arrangement and number of poles.

4. Contact temperatures of bypass/isolation switches shall not exceed those of automatic transfer-switch contacts when they are carrying rated load.

5. Operability: Constructed so load bypass and transfer-switch isolation can be performed by 1 person in no more than 2 operations in 15 seconds or less. Operation of the bypass/isolation switch shall be allowed regardless of the position of the automatic transfer switch. Switch operation shall provide for positive and complete sequencing of all contact motion and shall prevent any form of intermediate stop or delayed motion.

6. Engine Run Circuit Interface: There shall be sufficient controls included to assure that the engine run circuit remains closed when the switch is in the bypass-to-emergency position even though the associated transfer switch is in the normal position or completely removed from the enclosure.

7. Legend: Manufacturer's standard legend for control labels and instruction signs shall describe operating instructions.

8. Maintainability: Fabricate to allow convenient removal of major components from front without removing other parts or main power conductors. If the unit is constructed such that removal of components is not allowed, then the Automatic Transfer Switch section shall be isolated from the Bypass Isolation Switch section by means of insulated barriers.

9. The bypass isolation switch shall be provided with indicating lights identifying location in bypass position, full isolation position, and source availability.

C. Interconnection of Bypass/Isolation Switches with Automatic Transfer Switches: Factory-installed copper bus bars; plated at connection points and braced for the indicated available short-circuit current.

D. The bypass isolation switch maybe located in the same enclosure as the automatic transfer switch or maybe located separately in a dedicated enclosure adjacent to the automatic transfer switch enclosure.

E. The bypass/isolation switch shall maintain a mechanical separation of the normal and emergency power sources to guard against the inadvertent connection of unsynchronized sources together. Electrical interlocking alone will not be considered acceptable.

2.4 REMOTE ANNUNCIATOR SYSTEM

A. Functional Description: Remote annunciator panel shall annunciate conditions for indicated transfer switches. Annunciation shall include the following:

1. Sources available, as defined by actual pickup and dropout settings of transfer-switch controls.
2. Switch position.
3. Switch in test mode.
4. Failure of communication link.

B. Annunciator Panel: LED-lamp type with audible signal and silencing switch.

1. Indicating Lights: Grouped for each transfer switch monitored.
2. Label each group, indicating transfer switch it monitors, location of switch, and identity of load it serves.
3. Mounting: Flush, modular, steel cabinet, unless otherwise indicated.
4. Lamp Test: Push-to-test or lamp-test switch on front panel.

2.5 SOURCE QUALITY CONTROL

A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

2.6 IDENTIFICATION

A. Nameplates: Nameplates and label products are specified in Division 26 Section "Identification for Electrical Systems."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine transfer switches before installation. Reject equipment that is damaged, or rusted, or have been subjected to water saturation.

B. Examine areas, surfaces, substrates, and elements to receive transfer switches with Installer present, for compliance with requirements for installation tolerances, structural support, ventilation, temperature, humidity, and other conditions affecting performance of the Work.

1. Verify that field measurements are as indicated.

2. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment will be installed, before installation begins.

C. Examine roughing-in of conduits and grounding systems to verify the following:

1. Wiring entries comply with layout requirements.

2. Entries are within conduit-entry tolerances specified by manufacturer and no feeders will have to cross section barriers to reach load or line lugs.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install transfer switches and accessories in accordance with manufacturer’s instructions.

B. Coordinate layout and installation of equipment with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

C. Comply with mounting and anchoring requirements specified in Division 26 Section "Seismic Controls for Electrical Systems."

D. Floor-Mounted Switch: Install transfer switches on concrete bases.

1. Concrete Bases: 4 inches (100 mm) high, reinforced, with chamfered edges. Extend base no more than 3 inches (75 mm) in all directions beyond the maximum dimensions of transfer switches unless otherwise indicated or unless required for seismic anchor support. Construct concrete bases according to Division 26 Section "Hangers and Supports for Electrical Systems."

2. Anchor transfer switches to concrete bases according to manufacturer's written instructions, seismic codes at Project, and requirements in Division 26 Sections "Hangers and Supports for Electrical Systems" and "Seismic Controls for Electrical Systems."

3. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of base.

4. Install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.

5. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

6. Install anchor bolts to elevations required for proper attachment to transfer switches.

E. Annunciator and Control Panel Mounting: Flush in wall, unless otherwise indicated.

F. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, brackets, and temporary blocking of moving parts from enclosure and components.

G. Mount equipment plumb and rigid without distortion of enclosure.

H. Arrange conductors in auxiliary compartments and gutters into groups and bundle and wrap with wire ties.

I. Comply with NECA 1.

3.3 CONNECTIONS

A. Wiring to Remote Components: Match type and number of cables and conductors to control and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.

B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools for control wiring.

3.4 IDENTIFICATION

A. Equipment Nameplates: Label each contiguous main, or entrance, section with equipment nameplate.

B. Device Nameplates: Label each main and bypass device with a nameplate.

C. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Identification for Electrical Systems."

D. Diagram and Instructions:

1. Engraved, Laminated Acrylic or Melamine Label. Mount on front of transfer switch.

    a. Operating Instructions: Printed operating instructions for transfer switch, including key interlocking, control sequences, elementary single-line diagram, and emergency procedures.

2. Storage for Maintenance Instructions: Include a rack or holder, near the operating instructions, for a copy of maintenance manual.

E. Warning Labels: Label each panelboard with a warning label in accordance with NFPA 70 and NFPA 70E.

3.5 CLEANING

A. After completing equipment installation and before energizing, inspect unit components. Vacuum dirt and debris from interior of equipment; do not use compressed air to assist in

cleaning. Remove paint splatters and other spots. Repair exposed surfaces to match original finish.

3.6 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

3.7 ADJUSTING

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

B. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

3.8 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control tests and inspections:

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Coordinate tests with tests of generator and run them concurrently.

D. Acceptance Testing Preparation:

1. After installing equipment but before equipment is energized, test for compliance with requirements.
2. Test insulation resistance for each bus, component, connecting supply, feeder, and control circuit.
3. Test continuity of each circuit.

E. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters. After electrical circuitry has been energized, test for compliance with requirements.
2. Verify that electrical control wiring installation complies with manufacturer's submittal by means of point-to-point continuity testing. Verify that wiring installation complies with requirements in Division 26 Sections.
3. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
    a. Check for electrical continuity of circuits and for short circuits.
    b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
    c. Verify that manual transfer warnings are properly placed.
    d. Perform manual transfer operation.

4. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.

    a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.

    b. Simulate loss of phase-to-ground voltage for each phase of normal source.

    c. Verify time-delay settings.

    d. Verify pickup and dropout voltages by data readout or inspection of control settings.

    e. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.

    f. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.

5. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.

    a. Verify grounding connections and locations and ratings of sensors.

    b. Observe reaction of circuit-interrupting devices when simulated fault current is applied at sensors.

6. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

7. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

F. Assist in field commissioning of equipment including pretesting and adjusting of equipment and components.

G. Transfer switches will be considered defective if they do not pass tests and inspections.

H. Prepare test and inspection reports, including a certified report that identifies transfer switches included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.9 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain equipment, instrumentation, and accessories, and to use and reprogram microprocessor-based control, monitoring, and display functions.

B. Video record demonstrations presentation for Owner’s records.

C. Coordinate this training with that for generator equipment.

END OF SECTION 263600

SECTION 264313 - SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This section includes field or factory-mounted Surge Protective Devices (SPDs) for low-voltage (120 to 600 V) power distribution and control equipment, including:

1. Surge Protection Devices at Distribution Equipment

1.2 DEFINITIONS

A. ATS: Acceptance Testing Specifications.

B. I*n* or I*nominal*: Nominal Discharge Current. Peak value of surge current, selected by the manufacturer, through the SPD having current wave shape of 8/20 microseconds where the SPD remains functional after 15 surges. I*n* is posted on the device UL label.

C. MCOV: Maximum Continuous Operating Voltage. The maximum continuous operating voltage rating of a Metal Oxide Varistor (MOV) that can be applied without the MOV being damaged and/or destroyed by thermal runaway. MCOV is posted on the device UL label.

D. SCCR: Short Circuit Current Rating. The maximum current rating the SPD can sustain without being damaged and/or destroyed. SCCR is posted on the device UL label.

E. SPD: Surge Protective Device. A broad class of protective devices, installed parallel with the distribution panel or service disconnect, meant to protect downstream electrical distribution equipment from the effects of high voltage surges on the line.

F. SPD Type definitions:

1. TYPE 2: Permanently connected SPDs intended for installation on the load side of the service equipment overcurrent device, including SPDs located at the branch circuit panel.

G. VPR: Voltage Protection Rating. The average of measured limiting voltage before and after Nominal Discharge Testing (In), rounded up to one of UL's VPR categories (indicated in the latest ANSI/UL 1449 edition) such as 330 volt, 400 volt, 500 volt, etc. VPR is posted on each device UL label.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordinate SPD devices with Division 26 Section "Electrical Power Monitoring and Control."

B. Coordinate layout and installation of SPDs and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access.

C. Fault-Current Study Coordination Study, and Overcurrent Protective Device Settings report must be completed and submitted for review prior to final order, assembly or shipping of the electrical distribution system components. If studies have not been approved prior to shipping, assembly or final ordering of the electrical distribution system components, all changes to the equipment necessitated by the results of the study will be provided by the contractor at no additional cost to the project. Refer to specification section "Overcurrent Protective Device Coordination Study".

D. Do not energize or connect any electrical or low voltage equipment to their sources until SPDs are installed and connected.

E. Do not perform insulation resistance tests of the distribution wiring equipment with the SPD installed. Disconnect before conducting insulation resistance tests and reconnect immediately after the testing is over.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Division 01 and Division 26 Section "General Electrical Requirements".

B. Product Data: For each SPD type, accessory, component and enclosure indicated. Include dimensions and Manufacturer's technical data on features, performance, electrical characteristics, ratings, weights, furnished options, specialties, accessories, and finishes. Tabulate model number, SPD type, system voltage, phases, modes of protection, MCOV, VPR, and I_n.

C. Shop Drawings: For SPDs.

1. Detail enclosure types and details.
2. Include general arrangement drawing showing dimensions and weights of each assembled device.
3. Include installation and mounting details for SPDs internal to equipment.
4. Detail bus connection configuration, current, and voltage ratings, including size and number of bus bars and current rating for each bus.
5. Detail short-circuits current rating of SPD assembly and overcurrent protective devices.
6. Include schematic and wiring diagrams for power, signal, and control wiring.
7. Include nameplate legends.
8. Include list of materials.

D. Product Certificates: For SPDs, from manufacturer.

E. Field quality-control reports.

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

F. Sample Warranty: For warranty.

G. Project Record Documents: Record actual installed equipment and circuiting arrangements.

H. Operation and Maintenance Data: For SPDs to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Routine maintenance requirements for SPDs and all installed components.

2. Manufacturer's written instructions for testing and adjusting SPDs.

3. Time-current curves for each type of overcurrent protective device.

4. Features and operating sequences, both automatic and manual.

I. Follow-up service reports.

1.5 QUALITY ASSURANCE

A. Test Equipment Suitability and Calibration: Comply with NETA ATS, "Suitability of Test Equipment" and "Test Instrument Calibration."

B. Source Limitations: Obtain SPDs of each type and associated components and accessories through one source from a single manufacturer.

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

D. Comply with IEEE C62.41.2 and test devices according to IEEE C62.45.

E. Comply with NEMA LS 1.

F. Comply with NFPA 70.

G. The SPDs shall be compliant with the restrictions of the Hazardous Substances (RoHS) Directive 2002/95/EC.

1.6 PROJECT CONDITIONS

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

B. Environmental Limitations:

1. Do not install SPDs until spaces are enclosed and weathertight. Equipment shall be protected from any remaining wet work in the space and work above equipment. Provide temporary HVAC system for maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).

b. Operating Temperature: 30 to 120 deg F (0 to 50 deg C).

c. Humidity: 0 to 85 percent, noncondensing.

d. Altitude: Less than 20,000 feet (6090 m) above sea level.

C. Interruption of Existing Electrical Service: Refer to Division 26, Section “General Electrical Requirements”.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space, protected from weather and so condensation will not form on or in units. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic. Handle carefully in accordance with manufacturer's instructions to avoid damage to equipment components, enclosure, and finish.

B. Handle and prepare SPD components according to manufacturer's written instructions.

1.8 WARRANTY

A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge suppressors that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

1.9 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Replaceable Protection Modules: One of each size and type installed.

PART 2 - PRODUCTS

2.1 GENERAL

A. Manufacturers:

1. ABB USA.
2. Eaton.
3. Intermatic, Inc.
4. LEA International.
5. Leviton Mfg. Company Inc.
6. Siemens.
7. Schneider Electric.
8. Surge Suppression Incorporated.
9. Vertiv.

B. Surge Protective Device Ratings: Device type ratings shall be:

1. Type 2 - Service entrance equipment or distribution equipment

C. Nominal System Voltage: Match the system voltage to which the SPD is connected, as indicated on the drawings.

D. Maximum Continuous Operating Voltage: Not less than 125 percent of nominal system voltage for 240V or less power systems, and not less than 115 percent of nominal system voltage for 600V and 480V power systems.

E. Comply with ANSI/UL 1449.

2.2 SURGE PROTECTION DEVICES AT DISTRIBUTION EQUIPMENT

A. Surge Protection Devices: Integrally mounted, wired-in, solid-state, parallel-connected, modular (with field-replaceable modules) type, with sine-wave tracking suppression and filtering modules, short-circuit current rating matching or exceeding the available short-circuit indicated on the plans, and with the following features and accessories:

1. Fuses, rated at 200-kA interrupting capacity.
2. Fabrication using bolted compression lugs for internal wiring.
3. Integral disconnect switch.
4. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
5. LED indicator lights for power and protection status.
6. Six-digit transient-event counter set to totalize transient surges.

B. Nominal Discharge current (I_n): The SPD shall be tested to meet UL 1449 Nominal Discharge Current requirements. All modes of protection shall be tested including any required overcurrent protection.

1. Type 2 SPD's shall be tested and labeled at 20kA per mode.

C. Peak Surge Current Rating: Minimum single-pulse surge current withstand rating per phase must not be less than 150 kA. Peak surge current rating must be arithmetic sum of the ratings of individual MOVs in a given mode.

D. Protection Modes:

1. Protection mode VPR for grounded wye circuits, 3-phase, 4-wire circuits shall be as follows:

	480Y/277 V	208Y/120 V
Line to Neutral	1200	700
Line to Ground	1200	700
Neutral to Ground	1200	700

2.3 ENCLOSURES

A. All SPD Units shall be fully enclosed unless otherwise noted. Provide enclosures suitable for the locations indicated and as described below:

1. Indoor Enclosures:

a. NEMA 250 Type 1 constructed of a polymer or steel material

2. Outdoor Enclosures:

a. NEMA 250 Type 3R constructed of steel material and with a gasket to exclude dirt, windblown dust, and water (rain, sleet, and snow) from entering the enclosure when shut.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surge suppression devices before installation. Reject equipment that is damaged, or rusted, or have been subjected to water saturation.

B. Examine areas, surfaces, substrates, and elements to receive SPDs with Installer present, for compliance with requirements for installation tolerances, structural support, ventilation, temperature, humidity, and other conditions affecting performance of the Work.

1. Verify that field measurements are as indicated.

2. Verify that manufacturer's written instructions for environmental conditions have been established in spaces where equipment will be installed, before installation begins.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install SPDs and accessories in accordance with manufacturer’s instructions.

B. Coordinate layout and installation of equipment with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access.

C. Install SPD devices at service entrance on load side, with ground lead bonded to service entrance ground.

D. Install SPD devices for panelboards and auxiliary panels with conductors or buses between suppressor and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

E. Mount equipment plumb and rigid without distortion of enclosure.

F. Install fuses in fusible devices.

G. Comply with NECA 1.

3.3 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools for control wiring.

3.4 IDENTIFICATION

A. Nameplates: Label external device enclosures with equipment served.

B. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Identification for Electrical Systems."

C. Warning Labels: Label device with a warning label in accordance with NFPA 70 and NFPA 70E.

3.5 CLEANING

A. After completing equipment installation and before energizing, inspect unit components. Vacuum dirt and debris from interior of equipment; do not use compressed air to assist in cleaning. Remove paint splatters and other spots. Repair exposed surfaces to match original finish.

3.6 ADJUSTING

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

3.7 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control tests and inspections:

B. Acceptance Testing Preparation:

1. After installing SPD but before equipment is energized, test for compliance with requirements.
2. Verify that electrical wiring installation complies with manufacturer's written installation requirements.
3. Complete startup checks according to manufacturer's written instructions.
4. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Report results of tests and inspections in writing. Attach a label or tag to each tested component indicating satisfactory completion of tests.

D. SPDs will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 264313

SECTION 265100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Included in the work of this section are labor, material, and appurtenances required to complete the work of this Section as specified herein, including, but not limited to:

1. Interior light fixtures, LEDs, reflectors, lenses or faceplates, drivers and power supplies (includes exterior light fixtures normally installed on exterior surfaces of buildings).
2. LED Emergency Driver
3. Light fixture supports.

1.2 DEFINITIONS

A. CCT: Correlated color temperature

B. CRI: Color-rendering index.

C. CU: Coefficient of utilization.

D. IC Rated: Rated for direct contact with insulation.

E. L70: minimum 70% maintained initial-rated lumens at average rated life for LEDs

F. LED: Light Emitting Diode

G. LED Lamp: Replaceable LED light source with an integral driver within envelope of lamp. Lamp/Base types may include MR16/bi-pin, PAR/medium base, etc.

H. LED Module or LED Light Engine: Light source that contains LEDs, and may include additional components such as lenses, reflectors, or refractors, however do not include drivers.

I. LER: Light fixture (Luminaire) efficiency rating.

J. Light Fixture: Complete light fixture, including driver housing if provided.

K. LPD: Lighting power density.

L. RCR: Room cavity ratio.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Unless otherwise noted, perform all electrical Work required for the proper installation and operation of equipment, furnishings, devices and systems specified in other Divisions of these Specifications, furnished under other contracts, and/or furnished by the Owner for installation under this Contract.

B. Coordinate layout and installation of light fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including, but not limited to,

HVAC equipment, fire-suppression system, and partition assemblies. Contractor shall arrange his installation in proper relation to other work so that there shall be no interference, damage or delay to other trades' work

C. Give ample notice of any special openings or rough-in work required for placing electrical/lighting work so as to avoid cutting or removal of completed work.

D. Where work of this Section is to be flush or concealed, install it so it does not project beyond finished lines of walls, ceilings or floor surface.

E. Verify all ceiling systems and coordinate light fixture type and accessories prior to ordering light fixtures. Coordinate and cooperate with ceiling installer in regards to the location and installation of light fixtures.

1.4 SUBMITTALS

A. General:

1. Only those light fixtures and manufacturers per each fixture type designated and listed in the Light Fixture Schedule or on the Drawings, and approved in accordance with SUBSTITUTIONS paragraph in Part 1 of this specification section, or both, will be accepted. Where the Light Fixture Schedule indicates an allowance to be made for a specific light fixture, the price is a contractor price and monies shall be allotted for freight, installation, and lamping (if designated). Alternate manufacturers presented at bid shall be disqualified.
2. Submit all light fixtures, specified for use on this Project, in a single submittal package of portfolios, so that all light fixtures can be reviewed at one time.
3. Prepare portfolios from manufacturer's standard specification sheets, and include the fixture tag indicated on the Light Fixture Schedule to identify each light fixture. Do not combine more than one light fixture type on a single sheet.
4. Fixture or other materials shall not be shipped, stored, or installed into the work without approval of shop drawings.
5. Modifications to fixtures shall be in accordance with Contract Administrator's comments.

B. Product Data: For each type of light fixture, collated and bound in sets, and arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Summary page with the following for each light fixture type
    a. The number, type and wattage of the light fixture lamps or LEDs (including, but not limited to, assemblies, arrays, bars or modules).
    b. Light fixture driver or auxiliary device manufacturer, number and type.
2. Fixture cut sheets with name of manufacturer and options to be provided marked, including, but not limited to, voltage, lensing, and finish/color.
    a. Descriptive information providing physical characteristics of light fixture, including, but not limited to, materials, dimensions, fixture efficacy and/or efficiency, and verification of indicated parameters.
    b. For LED fixtures, include also L70 lifetime and wattage of luminaire including driver/power supply losses.

3. Light fixture mounting details, including non-standard outlet boxes.

4. Construction of light fixture housing and door (if applicable).

5. Power supply, transformer, and/or driver cut sheet with options marked, providing physical description of auxiliary device including, but not limited to, voltage, power factor, amperage, wattage, and maximum remote distance charts between device and light fixture.

6. Lamp cut sheet with options marked, providing physical description of lamps, including, but not limited to, voltage, wattage, efficacy, CCT, CRI, lumens, and life expectancy.

    a. For LED lamps, include also number of MacAdam ellipse steps and L70 lifetime.

7. Photometric data, in IESNA format, including LM-79 for LED luminaires, based on laboratory tests of each light fixture type, outfitted with lamps, drivers, and accessories identical to those indicated for the light fixture as applied in this Project.

C. Shop Drawings: Show details of non-standard or custom light fixtures. Indicate dimensions, finish color, including, but not limited to, custom color, weights, methods of field assembly, components, features, accessories, and modifications. Scaled documents shall be provided for custom fixtures.

D. Submittal Schedule

1. Within 30 days of Division 26 contractor award, shop drawings covering all light fixtures within this section shall be forwarded to Contract Administrator to begin approval process. Any shop drawings submitted after the required time frame will require the contractor to submit only the 1st named manufacturer and associated specification data listed on the fixture schedule as the only approved manufacturer. No substitutions will be allowed after the specified time frame.

2. Within 15 days of “approved” and “approved as noted” shop drawings, contractor shall forward to Contract Administrator a guaranteed ship date for each specified fixture.

3. Within 15 days after contractor’s receipt of “reject and resubmit” or “not approved” shop drawings, contractor shall provide Contract Administrator with resubmitted shop drawings for only those fixtures deemed unacceptable.

4. Contractor is responsible to call to the attention of the Contract Administrator any submittals that have not been returned to him in a timely manner that may affect delivery of fixtures.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For lighting equipment and fixtures to include in operation and maintenance manuals.

G. Warranties: Special warranties specified in this Section.

1.5 SUBSTITUTIONS

A. Refer to Division 26 Section "General Electrical Requirements".

B. Prior to the Bid Date, substitutions will not be considered unless the Contracto Administrator has received written request for approval at least ten calendar days prior to the date for receipt of Bids. Include in each such request the Light Fixture Schedule designation, name of the material or equipment for which it is to be substituted and complete Product Data for the proposed substitute, as defined in SUBMITTALS above, and all other information necessary for an evaluation. Provide interior point-by-point photometric calculations, under both normal and emergency lighting conditions, as applicable, if required by the Engineer. Submit a $100.00 review fee to the Engineer with each such point-by-point calculation for use of electronic base files. The fee will be returned if the substitution is added to the specification.

C. During the Bid

1. Any proprietary, sole-sourced light fixture listed in the fixture schedule shall be unit priced only. Unit prices shall be clearly identified on the bid form.

2. Representative agents shall be allowed to offer mini-lot pricing (MLP). MLP shall be defined as:

   a. Agents can group only specified fixtures they represent, and

   b. Only represent in the region where the specification originated, and

   c. Exclude all fixtures outside their represented lines from the MLP, and

   d. Sole-sourced (proprietary) light fixtures shall not be included in the MLP.

3. Packaging of light fixtures will not be considered nor approved. Packaging is defined as: distributor(s) providing a single price for a light fixture package made up of specified and non-specified light fixtures. Any submittal package containing non-specified light fixtures or inclusion of lighting control systems will be immediately rejected in its entirety.

D. After the Bid Date, proposals to substitute light fixtures for those shown on the Drawings or specified herein, will only be considered as a deduct. Submit proposed substitutions separately, in Submittal form, with a list of proposed substitutions together with a deduct price for each substitution. Proposed substitutions will then be reviewed by the Contract Adminstrator.

E. During the construction period, no substitutions shall be considered if product delay is due to contractor's failure to order products in a timely manner after presentation of fixture schedules and specifications. Additional costs associated with air freight or special factory runs to meet schedule due to contractor's error shall be at the expense of contractor.

F. The Contract Administrator has the final authority as to whether the light fixture is an acceptable replacement to the specified item. The proposed substitution may also be rejected for aesthetic reasons if felt necessary or desirable. In the event the proposed substitutions herein described are rejected, provide the specified item(s).

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories:

1. Listed and labeled as defined in NFPA 70, Article 100, by an NRTL as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

2. Marked for intended use.

B. Comply with NFPA 70.

C. Regulatory Agencies: Provide fixtures conforming to nationally- or internationally-recognized accredited testing agencies, such as U.S., ETL, ARL, or others in acceptance with local code enforcement policy.

D. Electrical Components and Devices: Provide only fixtures that comply with National Electric Code (NEC), and in particular to Section 410. All ceiling recessed fixtures, whether indicated in a catalog number or not, shall be equipped with an integral thermal protection device.

1.7 WARRANTY

A. General Guarantee: For a period of one year after Owner's initial acceptance and establishment of the beginning date of the guarantee period, and at no cost to the Owner, Contractor shall promptly furnish and install replacements for any fixtures or components deemed by the Owner as defective in workmanship under normal operating conditions, excluding lamp replacement as noted in Special Warranty paragraph in this section. Contractor shall repair installed equipment on the job site to Owner's satisfaction. For any time during said guarantee period that fixtures are not fully functional due to defects in material or workmanship, Contractor shall provide or pay for suitable temporary light fixtures, and shall remove said temporary fixtures upon installation of replacement elements. Contractor shall furthermore guarantee replacement fixtures for a period of one year following replacement.

B. Contractor shall not be held responsible for damage of fixtures or equipment components occurring after the beginning of the guarantee period due to acts of vandalism, acts of war, or acts of God.

C. LED Warranties: Shall be free from defects in materials and workmanship for the period indicated from date of factory shipment.

1. LED Luminaires, including LED modules, arrays and drivers: Five years.

1.8 SEISMIC REQUIREMENTS

A. Seismic bracing, restraints, and controls for all electrical systems specified herein shall be designed and installed as required by Division 26 "Seismic Controls for Electrical Systems" and Division 20 Section "Seismic Controls for MEP Systems".

1.9 SPARES

A. Furnish spare materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Plastic Diffusers and Lenses: 1 for each type and rating installed.
2. LED Drivers: 1 for each type and rating installed.
3. Globes and Guards: 1 for each type and rating installed.

PART 2 - PRODUCTS AND MATERIALS

2.1 GENERAL

A. Manufacturers

1. In Light Fixture Schedule, the following requirements apply to product selection:
    a. Basis-of-Design Product: The design for each light fixture is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified that meets or exceeds performance characteristics of the named product.

B. Light Fixtures and Components

1. Provide light fixtures as shown on the drawings and/or specified. This shall include all lamps, material and labor to securely hang light fixtures, clean them and make them completely ready for use. Provide all hangers, supports, and miscellaneous hardware required to install light fixtures. Provide additional tie wires connected to structure to conform to applicable seismic requirements where required.
2. Light fixture models scheduled on the Drawings are to show the manufacturer, grade and style of light fixtures required. Regardless of the manufacturer's catalog number suffixes indicated, provide all options and features as described in the Light Fixture Schedule.
3. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures. Manufacturer of recessed fixtures shall provide mounting brackets suitable for connection to ceiling system structure. Modifications to standard mounting brackets shall be coordinated with contractor and delivered with fixture so that no delays to product delivery shall be allowed.
4. Metal Parts: Free of burrs and sharp corners and edges.
5. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.
6. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
7. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
    a. White Surfaces: 85 percent.
    b. Specular Surfaces: 83 percent.
    c. Diffusing Specular Surfaces: 75 percent.
    d. Laminated Silver Metallized Film: 90 percent.

8. Plastic Diffusers, Covers, and Globes:

   a. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

   b. Glass: Annealed crystal glass, unless otherwise indicated.

9. Fixture Finishes:

   a. Apply fixture finishes in a manner that assures a durable wear-resistant surfacing. Give exposed metal surfaces (brass, bronze, aluminum and others) and finished castings, except chromium-plated or stainless steel parts, an even coat of high-grade meth/acrylate lacquer or transparent epoxy.

10. Reflectors:

   a. Provide aluminum reflectors or reflecting cones for downlight style fixtures comprised of #12 aluminum reflector sheet, 0.57 inch (15 gauge) or heavier and free of tool-making indentations, including spinning lines caused by assembly techniques. All reflectors shall be of first-quality, anodized finish :Alzak" with specular or semi-specular finish and color as selected. Provide specular reflectors with no apparent brightness above 45 degrees from Nadir and semi-specular, diffuse reflectors with no apparent brightness above 75 degrees from Nadir.

11. Mounting hardware and trims:

   a. Coordinate as need to suit ceiling conditions.

   b. Light fixtures near or in contact with insulation shall comply with code.

   c. Maintain a 3" minimum working clearance between non-IC rated light future housings and insulation on all adjacent ductwork, piping, walls and ceilings.

12. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps, LEDs, and drivers. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

   a. Label shall include the following lamp, LEDs, and driver characteristics:

      1) "USE ONLY" and include specific lamp or LED type.

         a) LED type, wattage, beam angle (if applicable) for LED luminaires. Indicate maximum allowed wattage.

         b) CCT and CRI for all luminaires.

13. Emergency lights and exit signs with integral battery back-up shall be connected to a separate unswitched conductor bypassing all other controls and contactors. Allow battery to charge for a minimum of 48 hours before light level testing. In order to prevent battery damage, do not turn off power for extended periods of time after the emergency light has been powered.

2.2 LED EMERGENCY DRIVER

A. Internal Type: Self-contained battery, charger, and electronic circuitry, factory mounted within light fixture body and compatible with driver. Comply with UL 924.

1. Emergency Connection: Provide wattage as scheduled on drawings to an LED load. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture driver.

2. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.

    a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.

    b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

3. Battery: Sealed, high-temperature, maintenance-free, nickel-cadmium or lithium ion type. The batteries shall be of suitable rating and capacity to supply and maintain at not less than 87 1/ 2 percent of the nominal battery voltage for the total lamp load associated with the unit for a period of at least 1 1/ 2 hours, or the unit equipment shall supply and maintain not less than 60 percent of the initial emergency illumination for a period of at least 1 1/ 2 hours.

4. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.

2.3 DRIVERS FOR LED LUMINAIRES

A. Description: Designed for type and quantity of LED diodes of light fixture. Drivers shall tolerate sustained open circuit and short circuit output conditions without damage. Driver shall be designed for full light output unless dimmer or bi-level control is indicated:

1. Sound Rating: A.

2. Total Harmonic Distortion Rating: Less than 20 percent. Shall comply with ANSI C82.77.

3. Transient Voltage Protection: IEEE C62.41, Category A or better.

4. Power Factor: 0.90 or higher at full load.

5. Driver shall operate with maximum sustained variations of +/-10% input voltage and frequency with no damage to driver.

6. Driver output shall be regulated to maximum +/- 5% published load range or requirements of downstream LED fixture.

7. LED Current Crest Factor: 1.5 or less.

8. LED drivers shall not over-drive LEDs at a current or voltage above LED rated values in order to increase LED lumen output.

9. Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.

10. Meets EN610000 for input harmonics.

11. ROHS Compliant.

B. Dimming Drivers:

1. Dimming Range: Visually flicker-free, strobe-free, continuous dimming of source as follows, unless specifically noted otherwise in the Light Fixture Schedule whichever is more stringent:

    a. Luminaires: 100 to 10 percent of rated lumens.

2. 0-10V dimming drivers: Compliant with IEC 60929 standard for 4-wire dimming.

3. Compatibility: Certified by manufacturer for use with specific dimming control system and LED indicated.

4. Control: Coordinate to ensure that the dimming driver, power supply, controller, dimming module, and/or wallbox dimmer and connecting wiring are compatible.

2.4 LED LUMINAIRES

A. Comply with ANSI C78.377 for white light LED color range. Unless noted otherwise in the Light Fixture Schedule, LED color quality characteristics shall be 80 CRI minimum and 4000K CCT.

B. LED binning specification tolerance to be within 3 MacAdam ellipses of rated values or as indicated in the Light Fixture Schedule, whichever is more stringent. All LEDs used for same fixture type throughout the project to originate from same production bin.

C. Unless indicated otherwise in the Light Fixture Schedule, minimum 70% maintained initial-rated lumens at average rated life of as follows:

1. LED luminaires: 50,0000 hours

D. ROHS compliant

E. Manufacturer of LED chips will be evaluated based on the manufacturer's product literature and data. At a minimum, LED fixtures or lamps will incorporate Bridgelux, Cree, Nichia, Osram or Xicato LEDs; additional manufacturers may be considered however the Contract Administrator or Engineer has the authority to reject other manufacturers for technical or aesthetic reasons if felt necessary or desireable.

2.5 LIGHT FIXTURE SUPPORT COMPONENTS

A. Comply with Sections "260548 Seismic Controls for Electrical" and "260529 - Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

E. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

F. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify conditions of equipment and installation prior to beginning work.

B. Verify that equipment is ready for connecting, wiring, and energizing.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Light Fixtures: All work shall be executed to present a neat appearance. Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

C. Temporary Lighting: If it is necessary, and approved by Contract Administrator, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.

D. Connect wiring according to Section "260519 - Low-Voltage Electrical Power Conductors and Cables."

E. Through wiring of recessed light fixtures, in suspended ceilings, is not permitted. Connect each light fixture by a whip to a junction box. The whip shall be of sufficient length to allow the light fixture to be relocated within a 6-foot radius.

F. Wall Mounted Light fixtures

1. Unless otherwise noted, conceal all raceways and back boxes for wall mounted light fixtures. Coordinate all wall-mounted light fixtures with interior elevations. Where specific elevations or dimensions are not indicated, verify the correct location with Contract Administrator prior to installation. Contractor shall supply structure to support weight of fixture.

3.3 DIMMING

A. For dimmable light fixtures, provide both control and power wiring between light fixture and control device and between light fixtures. Quantity of low voltage and line voltage wiring and wire type shall be per manufacturer's recommendations. At a minimum, provide the following based on control type at either 120V or 277V, unless recommended otherwise by the manufacturer:

1. 0-10V – two low voltage conductors and two line voltage conductors plus ground

B. Coordinate light fixture and control device dimming types for compatibility.

3.4 COORDINATION

A. Light fixtures shown on the Electrical Drawings represent general arrangements only. Refer to Architectural Drawings for exact locations.

B. Coordinate the installation and location of light fixtures with other work and all other trades before installation to avoid conflicts. Coordinate light fixture locations in mechanical rooms with final installed piping and ductwork layouts.

C. Verify all ceiling systems and coordinate light fixture type and accessories prior to ordering light fixtures. Coordinate and cooperate with ceiling installer in regards to the location and installation of light fixtures.

D. Coordinate final light fuxture locations in walk-in coolers and freezers with refrigeration coils and other trades.

E. Wall-Mounted Light fixtures

1. Coordinate all wall-mounted light fixtures with the architectural features of the building. Where specific elevations or dimensions are not indicated, verify the correct location with the Contract Administrator prior to beginning any work.

3.5 ADJUSTING

A. Contractor shall adjust all light fixture sockets to match the lamp specified and aim all adjustable light fixtures as directed by the Contract Administrator.

3.6 FIELD QUALITY CONTROL

A. Clean light fixtures of dirt and debris upon completion of the installation. Protect installed light fixtures from damage during the remainder of the construction period.

B. Upon completion of the installation of light fixtures, and after building circuits have been energized, energize lighting branch circuits to demonstrate capability and compliance with the requirements. Where possible, correct malfunctioning units at the site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

C. At the time of final acceptance of this project by the Owner, ensure that all lamps are in working order and all light fixtures are fully lamped.

D. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

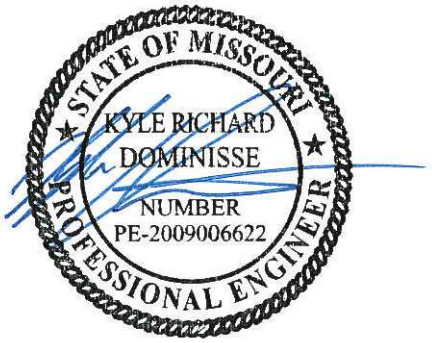
END OF SECTION 265100

Appendix 1

1. Structural Calculations

Calculation Package for Fulton Center Generator Replacement

September 5th, 2025



Prepared for

Missouri DOC

Prepared by

Walter P. Moore and Associates, Inc.
1100 Walnut Street, Suite 1825
Kansas City, MO 64106

Walter P Moore Project No.
D08.24014.01

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Governing Codes

Our calculations in this package follow the requirements of the 2015 International Existing Building Code (IEBC) with the City of Fulton, MO Amendments. We used the following referenced codes for the design:

- ASCE 7-10: “Minimum Design Loads and Associated Criteria for Buildings and other Structures”
- ACI 318-14: “Building Code Requirements for Structural Concrete”

Additionally, the 2016 Frost Depth Map by Missouri’s Public Service Commission (PSC) indicates that the frost depth for the City of Fulton is 15 inches.

LOAD DETERMINATION

Equipment Weight and Dimensions

The new 750 kV Cummins generator, model DQCB, has a higher footprint than the existing generator it replaces. Therefore, we will require a new concrete pad. The equipment weighs 23.191 lbs., to be mounted on spring isolators. Table 1 below shows the equipment's overall dimensions, based on cutsheets provided by the equipment vendor representative.

Table 1. New Generator Properties

Model	Weight (lbs.)	Length (in)	Width (in)	Height (in)	Base Length (in)	CG Height (in)
DQCB	23,191	259.7	101.06	119.53	200	45.1

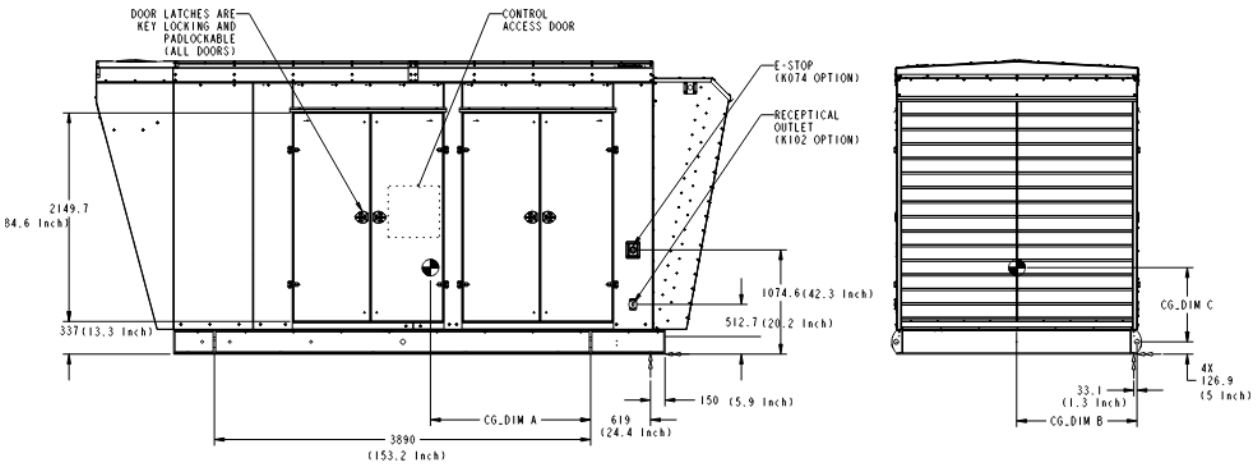


Figure 1. Generator side and front views

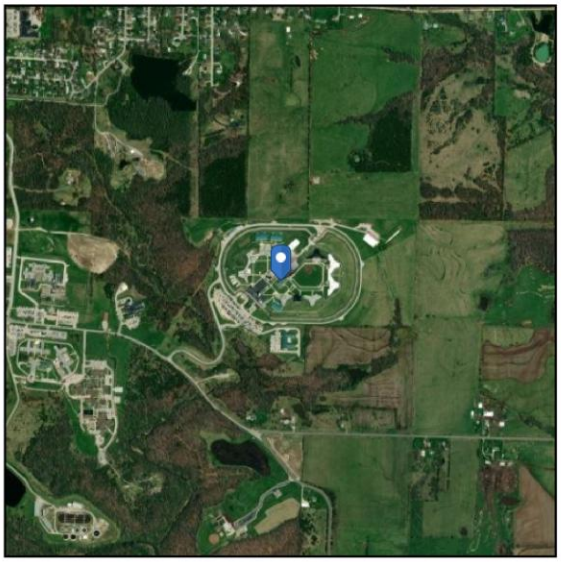
ASCE Hazard Report

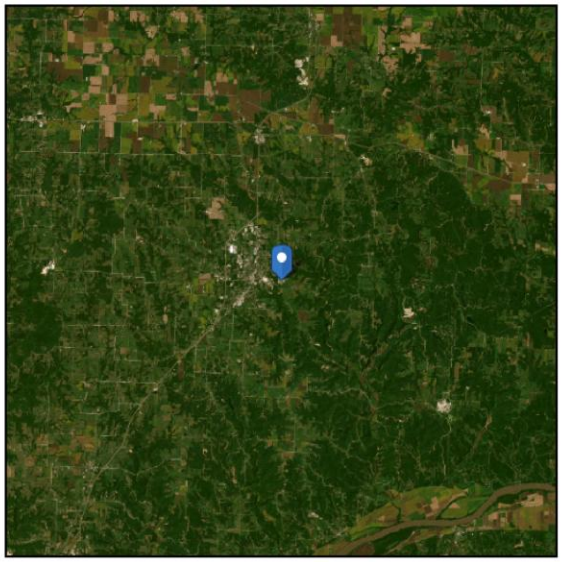
Following is the detailed output from ASCE's hazard tool website for the project location:

ASCE Hazards Report

Address:
No Address at This Location

Standard:	ASCE/SEI 7-10	**Latitude:**	38.845709
Risk Category:	III	**Longitude:**	-91.922637
Soil Class:	D - Stiff Soil	**Elevation:**	795.2081128777611 ft (NAVD 88)





Wind

Results:

Wind Speed	120 Vmph
10-year MRI	76 Vmph
25-year MRI	84 Vmph
50-year MRI	90 Vmph
100-year MRI	96 Vmph

Data Source: ASCE/SEI 7-10, Fig. 26.5-1B and Figs. CC-1–CC-4, and Section 26.5.2, incorporating errata of March 12, 2014
Date Accessed: Wed Jun 05 2024

Value provided is 3-second gust wind speeds at 33 ft above ground for Exposure C Category, based on linear interpolation between contours. Wind speeds are interpolated in accordance with the 7-10 Standard. Wind speeds correspond to approximately a 3% probability of exceedance in 50 years (annual exceedance probability = 0.000588, MRI = 1,700 years).

Site is not in a hurricane-prone region as defined in ASCE/SEI 7-10 Section 26.2.

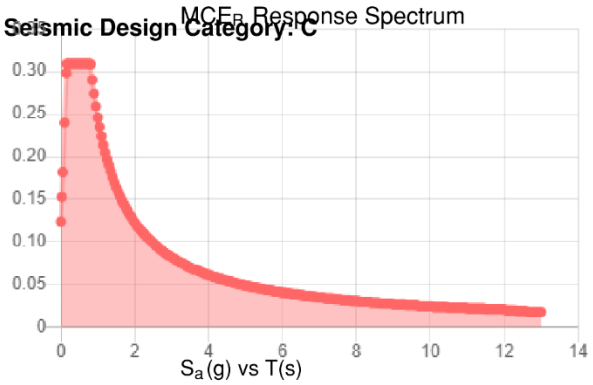
Seismic

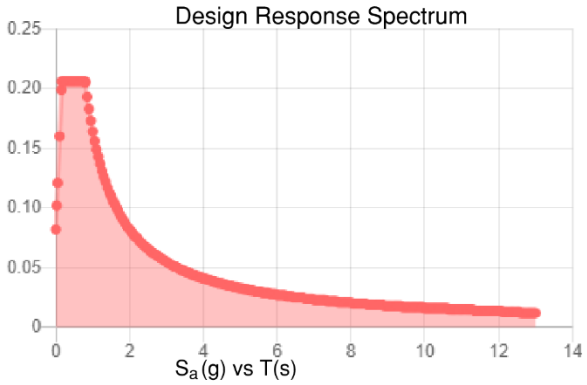
Site Soil Class: D - Stiff Soil

Results:

S_S :	0.193	S_{D1} :	0.164
S_1 :	0.103	T_L :	12
F_a :	1.6	PGA :	0.092
F_v :	2.387	PGA_M :	0.148
S_{MS} :	0.309	F_{PGA} :	1.6
S_{M1} :	0.246	I_e :	1.25
S_{DS} :	0.206		

Seismic Design Category: C





Data Accessed: Wed Jun 05 2024

Date Source:

USGS Seismic Design Maps based on ASCE/SEI 7-10, incorporating Supplement 1 and errata of March 31, 2013, and ASCE/SEI 7-10 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-10 Ch. 21 are available from USGS.

ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

Ice

Results:

Ice Thickness:	1.00 in.
Concurrent Temperature:	5 F
Gust Speed	40 mph
Data Source:	Standard ASCE/SEI 7-10, Figs. 10-2 through 10-8
Date Accessed:	Wed Jun 05 2024

Ice thicknesses on structures in exposed locations at elevations higher than the surrounding terrain and in valleys and gorges may exceed the mapped values.

Values provided are equivalent radial ice thicknesses due to freezing rain with concurrent 3-second gust speeds, for a 50-year mean recurrence interval, and temperatures concurrent with ice thicknesses due to freezing rain. Thicknesses for ice accretions caused by other sources shall be obtained from local meteorological studies. Ice thicknesses in exposed locations at elevations higher than the surrounding terrain and in valleys and gorges may exceed the mapped values.

Snow

Results:

Ground Snow Load, p_g :	20 lb/ft^2
Mapped Elevation:	795.2 ft
Data Source:	ASCE/SEI 7-10, Fig. 7-1.
Date Accessed:	Wed Jun 05 2024

Values provided are ground snow loads. In areas designated "case study required," extreme local variations in ground snow loads preclude mapping at this scale. Site-specific case studies are required to establish ground snow loads at elevations not covered.

Snow load values are mapped to a 0.5 mile resolution. This resolution can create a mismatch between the mapped elevation and the site-specific elevation in topographically complex areas. Engineers should consult the local authority having jurisdiction in locations where the reported ‘elevation’ and ‘mapped elevation’ differ significantly from each other.

Rain

Results:

15-minute Precipitation Intensity: 7.6 in./h

60-minute Precipitation Intensity: 3.36 in./h

Data Source: NOAA National Weather Service, Precipitation Frequency Data Server, Atlas 14 (https://www.nws.noaa.gov/oh/hdsc/)

Date Accessed: Wed Jun 05 2024

Wind Loads

We calculated the wind loads on the new generator using the specifications for rooftop equipment per ASCE 7-10. The resulting pressures are a conservative estimate of the wind pressures undergone by the new equipment.

Table 2. Wind pressures on new generator

Horizontal wind pressure (psf)	Vertical/uplift wind pressure (psf)
±50.5	39.9

The resultant horizontal wind load is applied at an elevation Z = 68 inches, corresponding to the equipment mid-height, including the added height from the spring isolators.

WALTER P MOORE

JOB NAME:	Fulton Generator Replacement		
JOB NO.:	D08.24014.01	DATE:	06/01/25
ENGINEER:	RC	DWG. REF.:	
TAB NO.:		SHEET NO.:	

Components and Cladding Wind Pressures - ASCE 7-10 (Flat, Gable, or Hip Roofs)

Design Method: ASCE 7-10

Building Classification:

ASCE 7-10 Basic Wind Speed, V:	120	mph
Exposure Category (B, C, D):	C	
α:	9.50	
z_g:	900	
Topographic factor, K_{zt}:	1.00	
Wind directionality factor, K_d:	0.85	
Internal pressure coefficient, $+GC_{pi}$:	0.18	
Internal pressure coefficient, $-GC_{pi}$:	-0.18	

Building Characteristics:

Angle of roof from horizontal, θ:	0	deg
Eave height, h:	10	ft
Least horizontal dimension:	24	ft
Parapet Height	0	ft
Max top of parapet elevation:	10	ft
Hip roof (Y or N)?	N	

Calculated Values:

Velocity pressure coeff. at h, K_h:	0.85	
Velocity pressure at h, q_h:	26.6	psf
Velocity press. coeff. at parapet, K_p:	0.85	
Velocity pressure at parapet, q_p:	26.6	psf
Width of pressure coeff. zone, a:	3.0	ft

Rooftop Equipment Pressures (h<60 ft):

GCr (lateral):	1.9	
GCr (uplift):	1.5	
Lateral pressure:	+/-50.5	psf
Uplift pressure:	39.9	psf

Cladding Type	Location	Effective Area (sf)	Coefficients +GCp	Coefficients -GCp	Wind pressures +p (psf)	Wind pressures -p (psf)
Wall	Interior	10	0.90	-0.99	+28.7	-31.1
		20	0.85	-0.94	+27.5	-29.8
		50	0.79	-0.88	+25.8	-28.2
		100	0.74	-0.83	+24.5	-26.9
		500	0.63	-0.72	+21.5	-23.9
Wall	Edge	10	0.90	-1.26	+28.7	-38.3
		20	0.85	-1.16	+27.5	-35.8
		50	0.79	-1.04	+25.8	-32.4
		100	0.74	-0.94	+24.5	-29.8
		500	0.63	-0.72	+21.5	-23.9
Roof	Interior	10	0.30	-1.00	+16.0	-31.4
		20	0.27	-0.97	+16.0	-30.6
		50	0.23	-0.93	+16.0	-29.5
		100	0.20	-0.90	+16.0	-28.7
		500	0.20	-0.90	+16.0	-28.7
Roof	Edge (Parapet<3ft)	10	0.30	-1.80	+16.0	-52.7
		20	0.27	-1.59	+16.0	-47.1
		50	0.23	-1.31	+16.0	-39.7
		100	0.20	-1.10	+16.0	-34.0
		500	0.20	-1.10	+16.0	-34.0
Roof	Corner (Parapet<3ft)	10	0.30	-2.80	+16.0	-79.3
		20	0.27	-2.29	+16.0	-65.7
		50	0.23	-1.61	+16.0	-47.7
		100	0.20	-1.10	+16.0	-34.0
		500	0.20	-1.10	+16.0	-34.0

Cladding Type	Location	Effective Area (sf)	Coefficients +GCp	Coefficients -GCp	Wind pressures +p (psf)	Wind pressures -p (psf)
Overhang	Interior	10	0.00	-1.70	+16.0	-50.0
		20	0.00	-1.67	+16.0	-49.2
		50	0.00	-1.63	+16.0	-48.1
		100	0.00	-1.60	+16.0	-47.3
		500	0.00	-1.10	+16.0	-34.0
Overhang	Edge (Parapet<3ft)	10	0.00	-1.70	+16.0	-50.0
		20	0.00	-1.67	+16.0	-49.2
		50	0.00	-1.63	+16.0	-48.1
		100	0.00	-1.60	+16.0	-47.3
		500	0.00	-1.10	+16.0	-34.0
Overhang	Corner (Parapet<3ft)	10	0.00	-2.80	+16.0	-79.3
		20	0.00	-2.20	+16.0	-63.3
		50	0.00	-1.40	+16.0	-42.1
		100	0.00	-0.80	+16.0	-26.1
		500	0.00	-0.80	+16.0	-26.1
Parapet	Interior	10	2.70	-1.89	+71.8	-50.3
		20	2.44	-1.79	+64.9	-47.7
		50	2.10	-1.67	+55.8	-44.4
		100	1.84	-1.57	+49.0	-41.8
		500	1.73	-1.35	+46.0	-35.9
Parapet	Edge (Parapet<3ft)	10	3.70	-2.16	+98.4	-57.5
		20	3.14	-2.02	+83.5	-53.6
		50	2.40	-1.83	+63.9	-48.6
		100	1.84	-1.68	+49.0	-44.8
		500	1.73	-1.35	+46.0	-35.9

Notes:
1. Positive pressures signify pressures acting toward the surface.
2. Positve wall pressures shown are calculated based on z = h. At lower elevations, windward pressures may be lower.
3. Negative pressures signify pressures acting away from the surface.
4. This spreadsheet is only valid for enclosed and partially enclosed buildings.
5. **Roof pressures are only valid for flat, gable, and hip roofs.**
6. No internal pressures are included for parapets because they cancel each other out.

Figure 2. Calculation spreadsheet for wind pressures on Components and Cladding

Seismic Loads

We calculated the seismic loads on the new equipment following the specifications of Chapter 13 of ASCE7-10 for spring-isolated components and systems. Table XX below summarizes the resulting seismic loads on the equipment:

Table 3.Resultant seismic loads on new generator

Horizontal seismic load (lbs.)	Vertical seismic load (lbs.)
±2,530	±1,012

The resultant horizontal seismic load is applied at an elevation Z = 53.1 inches, corresponding to the location of the center of gravity of the equipment, including the added height from the spring isolators.

JOB NAME: Fulton Center C
JOB NO.: D08.24014.01 DATE: 7/1/2025
ENGINEER: JP DWG. REF.:
TAB NO.: SHEET NO.:

Seismic Design Forces on Nonstructural Components and Anchorage Forces

Description: Generator Pad on Spring Isolators

Input Variables:

Code =	ASCE 7-10		
a_p =	2.50		Component amplification factor per ASCE 7-10 Table 13.5-1 or 13.6-1
R_p =	2.00		Component response modification factor per ASCE 7-10 Table 13.5-1 or 13.6-1
I_P =	1.00		Component importance factor per ASCE 7-10 section 13.1.3
S_{DS} =	0.20		Short-period design spectral response acceleration parameter per ASCE 7-10 section 11.4.4
W_P =	25300.0	lbs	Component operating weight
z =	0.0	ft	Component point of attachment elevation with respect to the base
h =	10.0	ft	Supporting structure average roof height relative to the base
Ω_O =	2.50		Overstrength factor per ASCE 7-10 Table 13.5-1 or 13.6-1

The horizontal seismic design force on Nonstructural components:

F_p =	2530.0	lbs	per ASCE 7-10, Eqn 13.3-1	$F_p = 0.4a_pS_{DS}W_p(1+2z/h)/(R_p/I_p)$
≤	8096.0	lbs	maximum, per ASCE 7-10 equation 13.3-2	$F_{p,max} = 1.6S_{DS}I_pW_p$
≥	1518.0	lbs	minimum, per ASCE 7-10 equation 13.3-3	$F_{p,min} = 0.3S_{DS}I_pW_p$

Therefore,

F_p =	**2530.0**	lbs	(= **0.10** x W_P)
$F_{p,anc}$ =	**2530.0**	lbs	

For Concurrent Vertical Force: **F_v = ± 1012.0 lbs** $F_v = \pm 0.2S_{DS}W_p$

Consider 100/30 Rule for Anchorage Forces: No

Figure 3. Calculation spreadsheet for seismic forces on non-structural components per Ch. 13 on ASCE 7-10

CONCRETE PAD VERIFICATION

Concrete pad model

We verified the existing generator pad using CSI's SAFE software. The table below shows the assumed properties for the concrete pad:

Table 4.Generator pad properties

Length (ft)	Width (ft)	Thickness (in)	f'_c (psi)	Reinforcement layout
18.25	10.25	24"	3,000	#4 @ 12" OC EA way at mid-depth

Critical soil pressures under the pad reached 944 psf. for the ASD load combination (D + L), well below the assumed allowable bearing pressure of 1,500 psf.

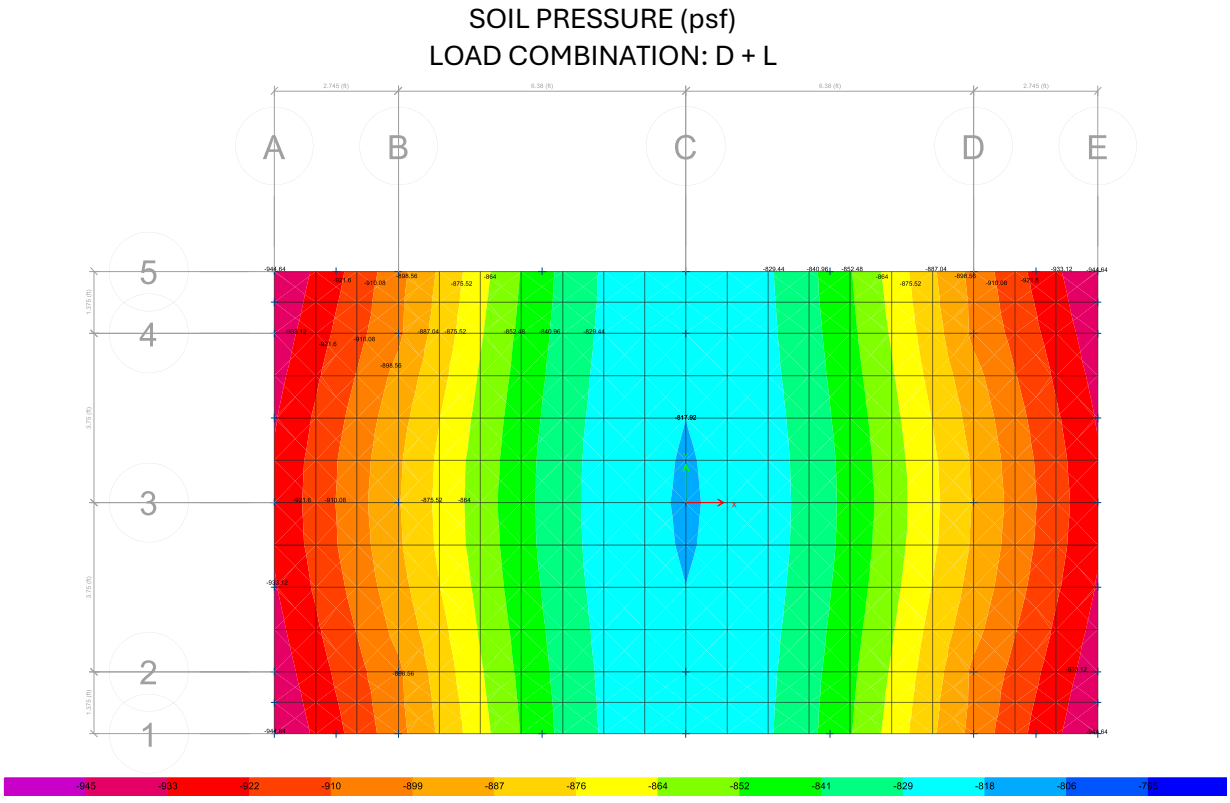
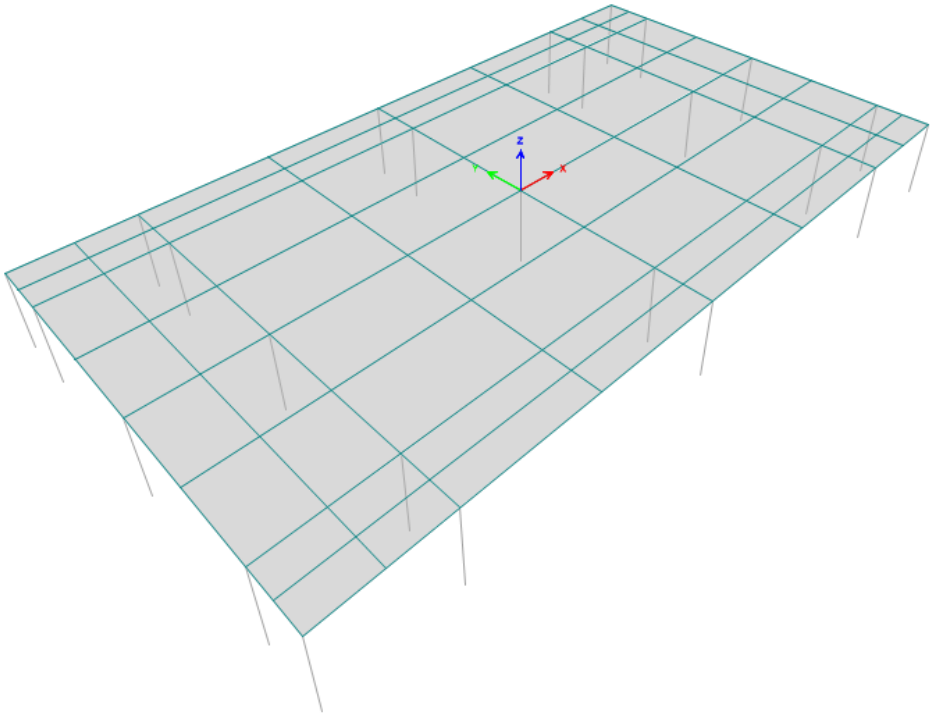


Figure 4. Resulting soil pressures for critical ASD load combination

Attached below is the analysis report of the slab model generated by SAFE, including the model properties, applied loads, and a summary of the design output.

SAFE ANALYSIS RESULTS

SAFE®



User Report 5

Model File: Fulton Generator Pad, Revision 0
9/4/2025

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List of Tables

1 Structure Data

This chapter provides model geometry information, including items such as story levels, point coordinates, and element connectivity.

1.1 Grid Data

Table 1.1 - Grid Definitions - General

Name	Type	Ux ft	Uy ft	Rz deg	Datum Name	Story Name Above	Story Name Below	Model Datum ft	Story Height Above ft	Story Height Below ft	Bubble Size in	Color
GLOBAL	Cartesian	0	0	0	Story1		Base	0		2	20	Gray6

Table 1.2 - Grid Definitions - Grid Lines

Name	Grid Line Type	ID	Ordinate ft	Bubble Location	Visible
GLOBAL	X (Cartesian)	A	-9.125	End	Yes
GLOBAL	X (Cartesian)	B	-6.38	End	Yes
GLOBAL	X (Cartesian)	C	0	End	Yes
GLOBAL	X (Cartesian)	D	6.38	End	Yes
GLOBAL	X (Cartesian)	E	9.125	End	Yes
GLOBAL	Y (Cartesian)	1	-5.125	Start	Yes
GLOBAL	Y (Cartesian)	2	-3.75	Start	Yes
GLOBAL	Y (Cartesian)	3	0	Start	Yes
GLOBAL	Y (Cartesian)	4	3.75	Start	Yes
GLOBAL	Y (Cartesian)	5	5.125	Start	Yes

1.2 Area Connectivity

Table 1.3 - Floor Object Connectivity

Unique Name	UniquePt1	UniquePt2	UniquePt3	UniquePt4	Perimeter ft	Area ft2
1	13	14	42	15	8.24	3.77
2	15	42	16	17	12.99	10.29
3	17	16	12	18	12.99	10.29
4	18	12	19	20	8.24	3.77
9	21	24	25	43	8.24	3.77
10	43	25	26	22	12.99	10.29
11	22	26	27	44	12.99	10.29
12	44	27	28	23	8.24	3.77
5	14	1	2	42	15.51	8.77
13	1	21	43	2	15.51	8.77
14	42	2	3	16	20.26	23.93
15	2	43	22	3	20.26	23.93
16	16	3	4	12	20.26	23.93
17	3	22	44	4	20.26	23.93
18	12	4	5	19	15.51	8.77
19	4	44	23	5	15.51	8.77

1.3 Strip Connectivity

Table 1.4 - Strip Object Connectivity

Name	Number Segments	Strip Start Point	Segment End Point	Start Width Left ft	Start Width Right ft	End Width Left ft	End Width Right ft	Auto Widen	Layer
CSA1	1	13	24	0.3438	0.3438	0.3438	0.3438	No	A
CSA2	1	15	25	0.9375	0.3438	0.9375	0.3438	No	A
CSA3	1	17	26	0.9375	0.9375	0.9375	0.9375	No	A
CSA4	1	18	27	0.3438	0.9375	0.3438	0.9375	No	A
CSA5	1	20	28	0.3438	0.3438	0.3438	0.3438	No	A
CSB1	1	13	20	0.6863	0.6863	0.6863	0.6863	No	B
CSB2	1	14	19	0.6863	1.595	0.6863	1.595	No	B
CSB3	1	1	5	1.595	1.595	1.595	1.595	No	B
CSB4	1	21	23	1.595	0.6863	1.595	0.6863	No	B
CSB5	1	24	28	0.6863	0.6863	0.6863	0.6863	No	B
MSA2	1	6	7	0.3438	0.3438	0.3438	0.3438	No	A
MSA3	1	9	10	0.9375	0.9375	0.9375	0.9375	No	A
MSA4	1	11	29	0.9375	0.9375	0.9375	0.9375	No	A
MSA5	1	30	31	0.3438	0.3438	0.3438	0.3438	No	A
MSB2	1	32	33	0.6863	0.6863	0.6863	0.6863	No	B
MSB3	1	34	35	1.595	1.595	1.595	1.595	No	B
MSB4	1	36	37	1.595	1.595	1.595	1.595	No	B
MSB5	1	38	39	0.6863	0.6863	0.6863	0.6863	No	B

2 Properties

This chapter provides property information for materials, frame sections, shell sections, and links.

2.1 Materials

Table 2.1 - Material Properties - General

Material	Type	SymType	Grade	Color	Notes
3000Psi	Concrete	Isotropic	f'c 3000 psi	Red	
A416Gr270	Tendon	Uniaxial	Grade 270	Red	
A615Gr60	Rebar	Uniaxial	Grade 60	Green	

2.2 Shell Sections

Table 2.2 - Area Section Property Definitions - Summary

Name	Type	Element Type	Material	Total Thickness in	Deck Material	Deck Depth in
SLAB	Slab	Shell-Thick	3000Psi	24		

2.3 Spring Properties

Table 2.3 - Spring Property Definitions - Area Springs

Name	Stiffness Option	Stiffnes U1 kip/in/in2	Stiffnes U2 kip/in/in2	Stiffnes U3 kip/in/in2	Nonlinear Option for U3	Color	Notes
SOIL	User	0	0	0.1	Compression Only	Red	

3 Assignments

This chapter provides a listing of the assignments applied to the model.

3.1 Shell Assignments

Table 3.1 - Area Assignments - Summary

UniqueName	Section Property	Property Type	Spring
1	SLAB	Slab	SOIL
2	SLAB	Slab	SOIL
3	SLAB	Slab	SOIL
4	SLAB	Slab	SOIL
9	SLAB	Slab	SOIL
10	SLAB	Slab	SOIL
11	SLAB	Slab	SOIL
12	SLAB	Slab	SOIL
5	SLAB	Slab	SOIL
13	SLAB	Slab	SOIL
14	SLAB	Slab	SOIL
15	SLAB	Slab	SOIL
16	SLAB	Slab	SOIL
17	SLAB	Slab	SOIL
18	SLAB	Slab	SOIL
19	SLAB	Slab	SOIL

Table 3.2 - Area Assignments - Area Springs

UniqueName	Spring Property
1	SOIL
2	SOIL
3	SOIL
4	SOIL
9	SOIL
10	SOIL
11	SOIL
12	SOIL
5	SOIL
13	SOIL
14	SOIL
15	SOIL
16	SOIL
17	SOIL
18	SOIL
19	SOIL

4 Loads

This chapter provides loading information as applied to the model.

4.1 Load Patterns

Table 4.1 - Load Pattern Definitions

Name	Is Auto Load	Type	Self Weight Multiplier	Auto Load
~LLRF	No	Other	0	
Dead	No	Dead	1	
Live	No	Live	0	
Seismic Hor	No	Seismic	0	None
Seismic Vert	No	Seismic	0	None
Wind Hor	No	Wind	0	None
Wind Vert	No	Wind	0	None

4.2 Applied Loads

4.2.1 Point Loads

Table 4.2 - Joint Loads Assignments - Force

UniqueName	Load Pattern	FX kip	FY kip	FZ kip	MX kip-ft	MY kip-ft	MZ kip-ft	X Dimension in	Y Dimension in
42	Dead	0	0	-5.8	0	0	0	8	4
43	Dead	0	0	-5.8	0	0	0	8	4
44	Dead	0	0	-5.8	0	0	0	8	4
12	Dead	0	0	-5.8	0	0	0	8	4
42	Seismic Hor	0	0.633	0.75	0	0	0	0	0
43	Seismic Hor	0	0.633	0.75	0	0	0	0	0
44	Seismic Hor	0	0.633	-0.75	0	0	0	1	1
12	Seismic Hor	0	0.633	-0.75	0	0	0	1	1
42	Wind Hor	0	2.72	4.113	0	0	0	0	0
43	Wind Hor	0	2.72	4.113	0	0	0	0	0
44	Wind Hor	0	2.72	-4.113	0	0	0	0	0
12	Wind Hor	0	2.72	-4.113	0	0	0	1	1
42	Seismic Vert	0	0	0.253	0	0	0	0	0
43	Seismic Vert	0	0	0.253	0	0	0	0	0
44	Seismic Vert	0	0	0.253	0	0	0	0	0
12	Seismic Vert	0	0	0.253	0	0	0	1	1
42	Wind Vert	0	0	1.818	0	0	0	0	0
43	Wind Vert	0	0	1.818	0	0	0	0	0
44	Wind Vert	0	0	1.818	0	0	0	0	0
12	Wind Vert	0	0	1.818	0	0	0	1	1

4.2.2 Area Loads

Table 4.3 - Area Load Assignments - Uniform

UniqueName	Load Pattern	Direction	Load lb/ft2
1	Live	Gravity	40
2	Live	Gravity	40
3	Live	Gravity	40
4	Live	Gravity	40
9	Live	Gravity	40
10	Live	Gravity	40

UniqueName	Load Pattern	Direction	Load lb/ft2
11	Live	Gravity	40
12	Live	Gravity	40
5	Live	Gravity	40
13	Live	Gravity	40
18	Live	Gravity	40
19	Live	Gravity	40

4.3 Load Cases

Table 4.4 - Load Case Definitions - Summary

Name	Type
Dead	Nonlinear Static
Live	Nonlinear Static
Seismic Horizontal	Nonlinear Static
Wind Horizontal	Nonlinear Static
Seismic Vertical	Nonlinear Static
Wind Vertical	Nonlinear Static

4.4 Load Combinations

Table 4.5 - Load Combination Definitions

Name	Type	Is Auto	Load Name	SF	Notes
1) 1.4D	Linear Add	No	Dead	1.4	
2) 1.2D + 1.6L	Linear Add	No	Dead	1.2	
2) 1.2D + 1.6L			Live	1.6	
4) 1.2D + 1.0W + L	Linear Add	No	Dead	1.2	
4) 1.2D + 1.0W + L			Wind Horizontal	1	
4) 1.2D + 1.0W + L			Live	1	
5) 0.9D + 1.0W	Linear Add	No	Dead	0.9	
5) 0.9D + 1.0W			Wind Horizontal	1	
5) 0.9D + 1.0W			Wind Vertical	1	
6) 1.2D +E + L + 0.2S	Linear Add	No	Dead	1.2	
6) 1.2D +E + L + 0.2S			Seismic Horizontal	1	
6) 1.2D +E + L + 0.2S			Seismic Vertical	-1	
7) 0.9D - E	Linear Add	No	Dead	0.9	
7) 0.9D - E			Seismic Horizontal	1	
7) 0.9D - E			Seismic Vertical	1	
ASD 1) D	Linear Add	No	Dead	1	
ASD 2) D + L	Linear Add	No	Dead	1	
ASD 2) D + L			Live	1	
ASD 5) D + 0.6W	Linear Add	No	Dead	1	
ASD 5) D + 0.6W			Wind Horizontal	0.6	
ASD 5) D + 0.7E	Linear Add	No	Dead	1	
ASD 5) D + 0.7E			Seismic Horizontal	0.7	
ASD 5) D + 0.7E			Seismic Vertical	-0.7	
ASD 7) 0.6D + 0.6W	Linear Add	No	Dead	0.6	
ASD 7) 0.6D + 0.6W			Wind Horizontal	0.6	
ASD 7) 0.6D + 0.6W			Wind Vertical	0.6	
ASD 7) 0.6D + 0.7E	Linear Add	No	Dead	0.6	
ASD 7) 0.6D + 0.7E			Seismic Horizontal	0.7	
ASD 7) 0.6D + 0.7E			Seismic Vertical	0.7	

5 Analysis Results

This chapter provides analysis results.

5.1 Structure Results

Table 5.1 - Base Reactions

Output Case	Case Type	FX kip	FY kip	FZ kip	MX kip-ft	MY kip-ft	MZ kip-ft	X ft	Y ft	Z ft
1) 1.4D	Combination	0	0	111.046	0	0	0	0	0	-2
2) 1.2D + 1.6L	Combination	0	0	227.94	0	0	0	0	0	-2
4) 1.2D + 1.0W + L	Combination	0	-10.88	257.475	83.455	-1.399E-06	2.266E-05	0	0	-2
5) 0.9D + 1.0W	Combination	0	-10.88	222.752	83.455	-1.399E-06	2.266E-05	0	0	-2
6) 1.2D +E + L + 0.2S	Combination	0	-2.532	96.195	16.314	0	6.315E-06	0	0	-2
7) 0.9D - E	Combination	0	-2.532	229.012	16.314	0	6.315E-06	0	0	-2

6 Design Data

This chapter provides design data and results.

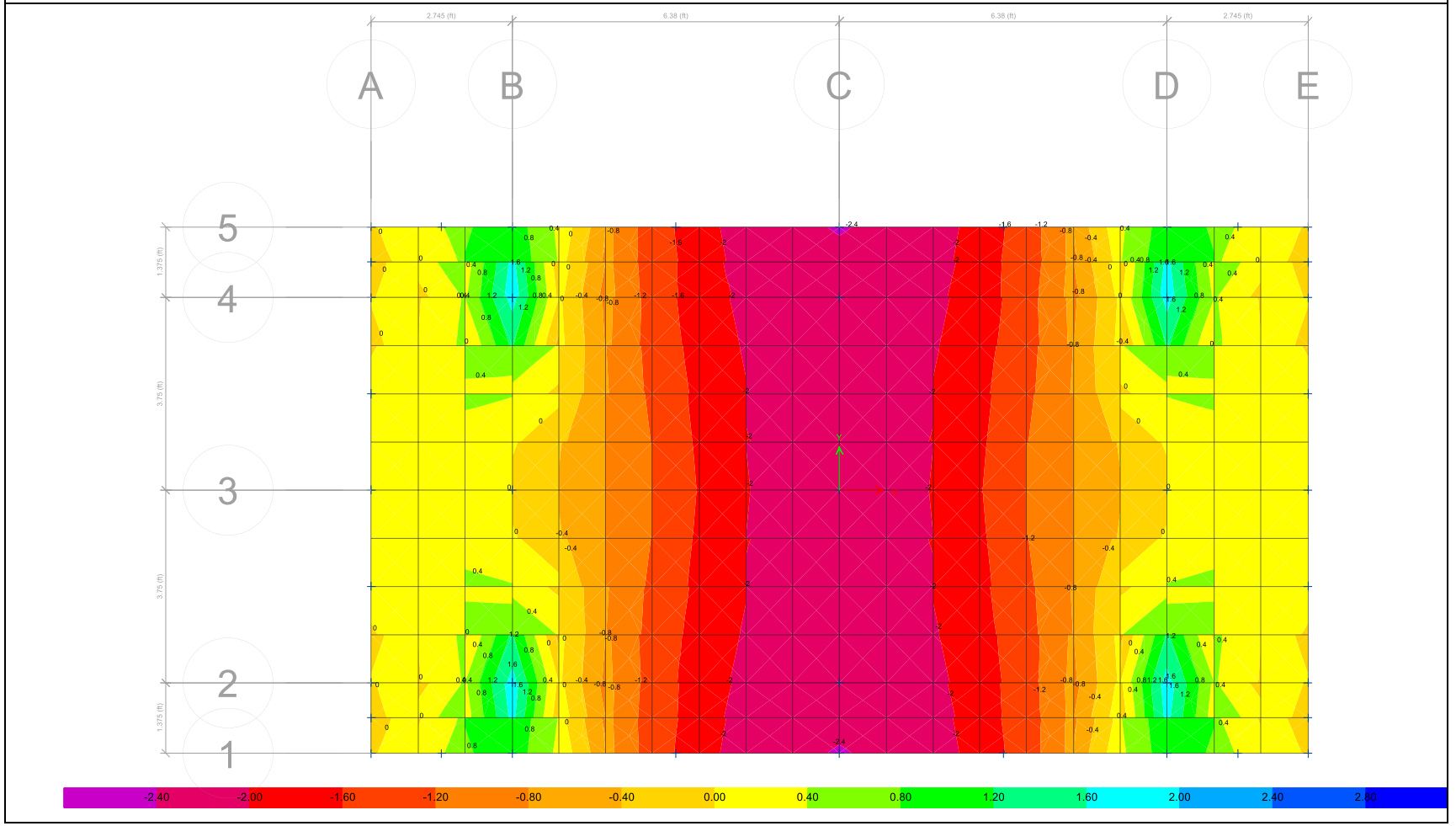
6.1 Concrete Slab Design

Table 6.1 - Concrete Design Preferences - ACI 318-19

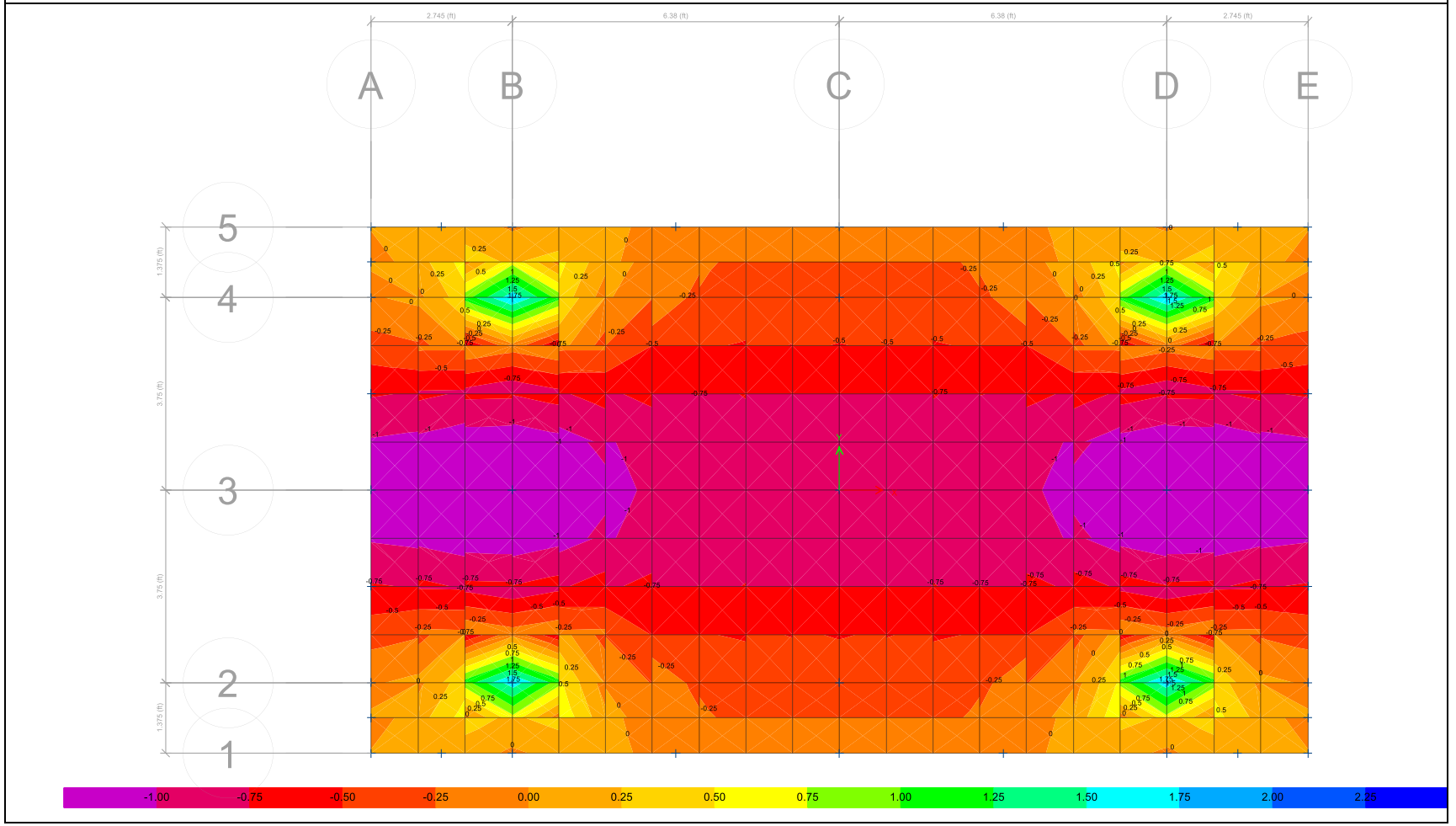
Item	Value
PhiTen	0.9
PhiComp	0.65
PhiShear	0.75
Increase Flexural Rebar?	No
Overwrite Shear Lambdas to One for Mats and Footings?	Yes
Ignore Pu?	Yes
Pattern Live Load Factor	0.75
CoverTop in	11.75
CoverBot in	11.75
BarSize	#4
InnerLayer	Layer B
PTCGSTop in	1
PTCGSBotExt in	1.75
PTCGSBotInt in	1
SlabType	Two Way
Cover Beam Top in	1.5
Cover Beam Bottom in	1.5
Bar Size Beam Flexure	#9
Bar Size Beam Shear	#4
PTCGS Beam Top in	2
PTCGS Beam Bottom in	2
UserStress	No
InitConcRat	0.8
LLFraction	0.5

MOMENT DIAGRAMS ON PAD

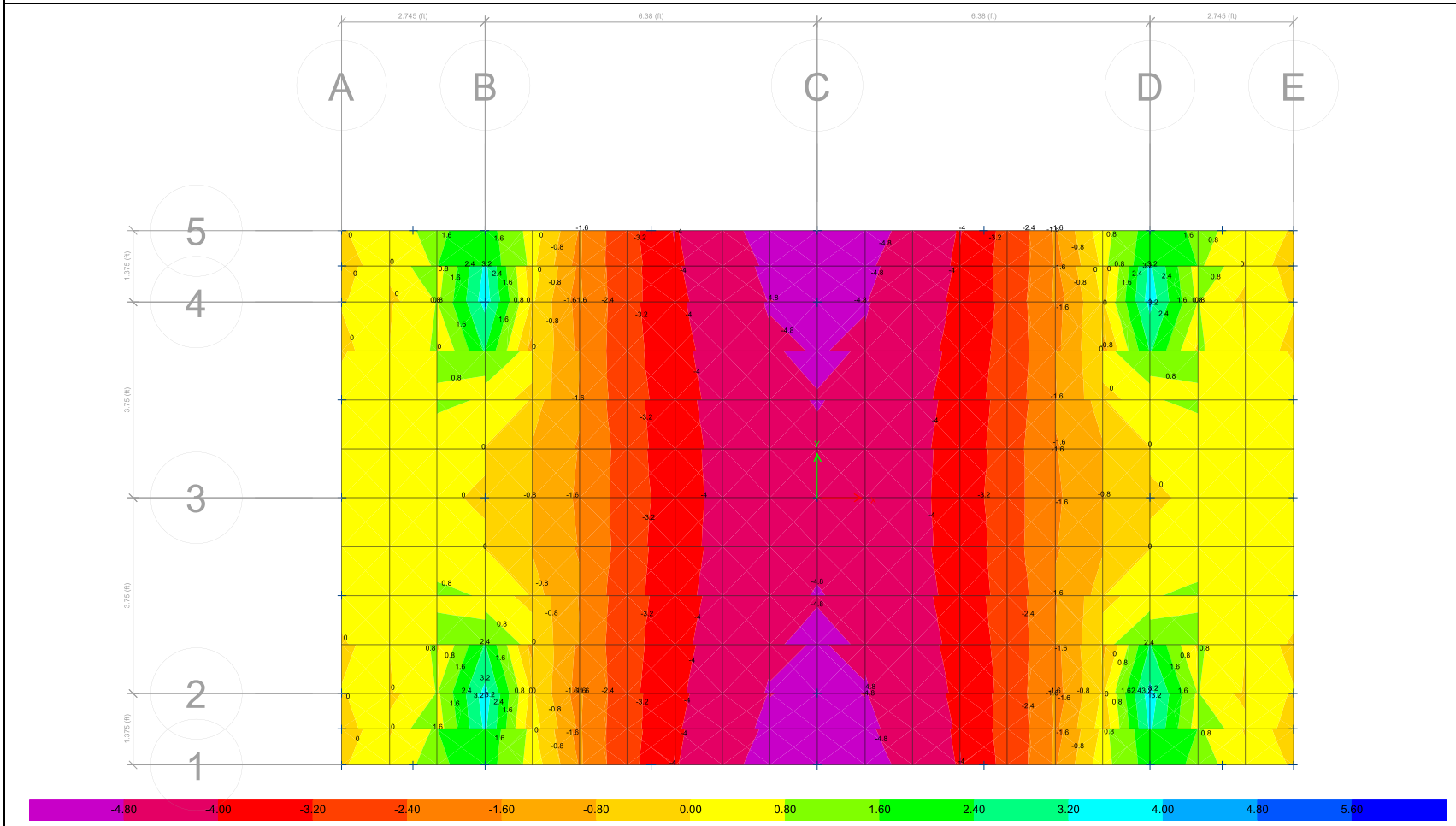
LOAD COMBINATION 1 – M11 (kip-ft/ft)



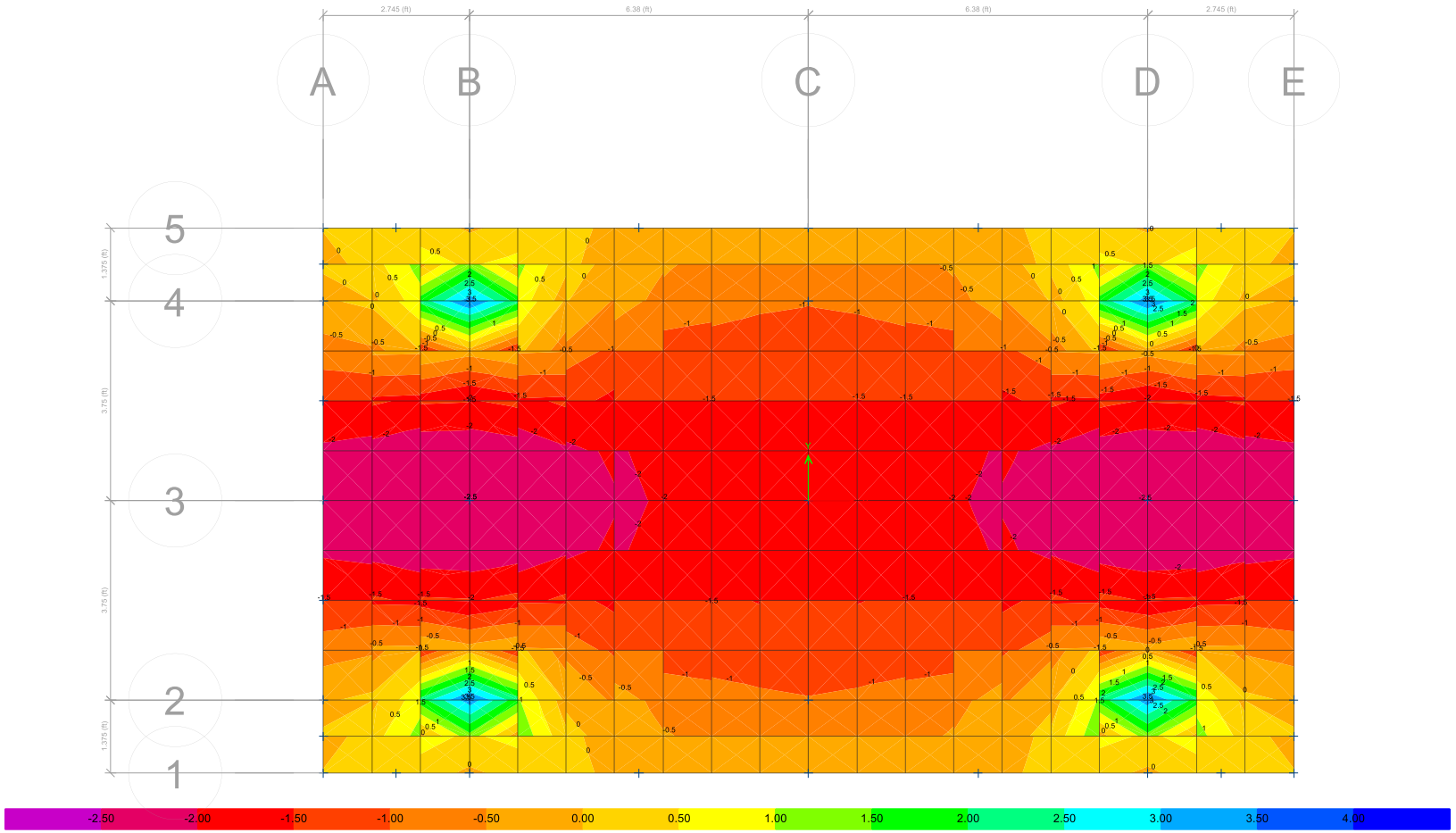
LOAD COMBINATION 1 – M22 (kip-ft/ft)



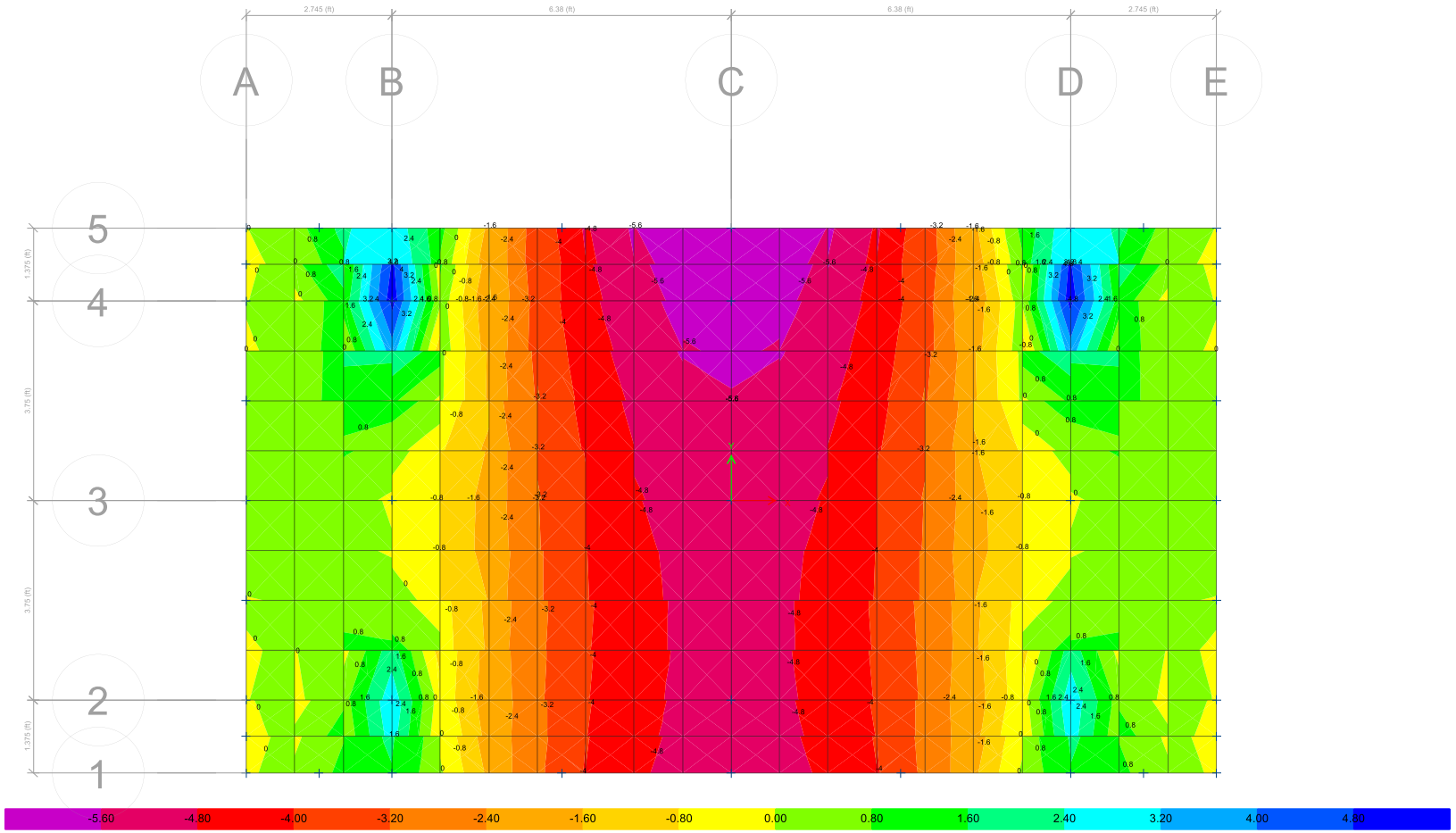
LOAD COMBINATION 2 – M11 (kip-ft/ft)



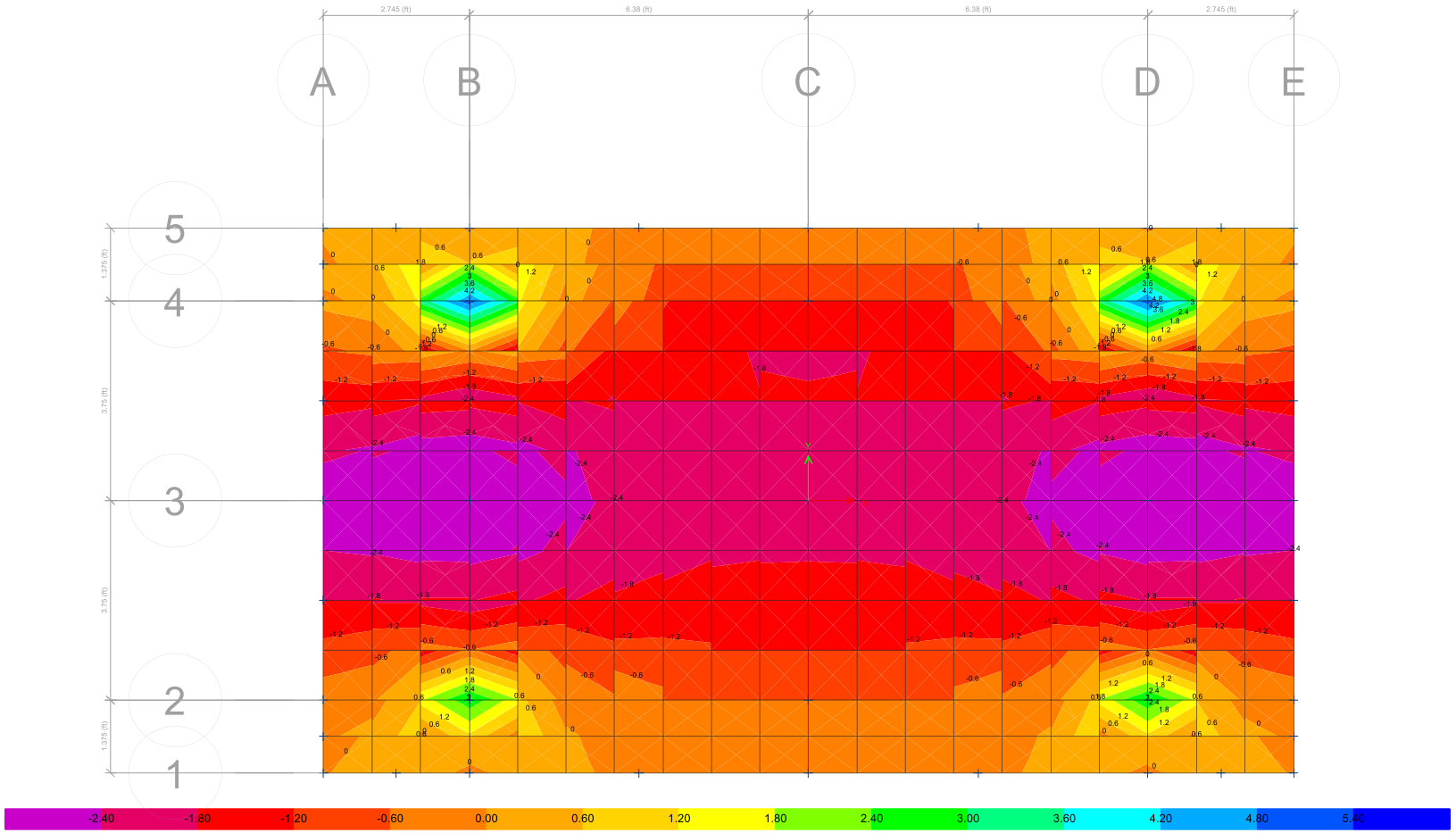
LOAD COMBINATION 2 – M22 (kip-ft/ft)



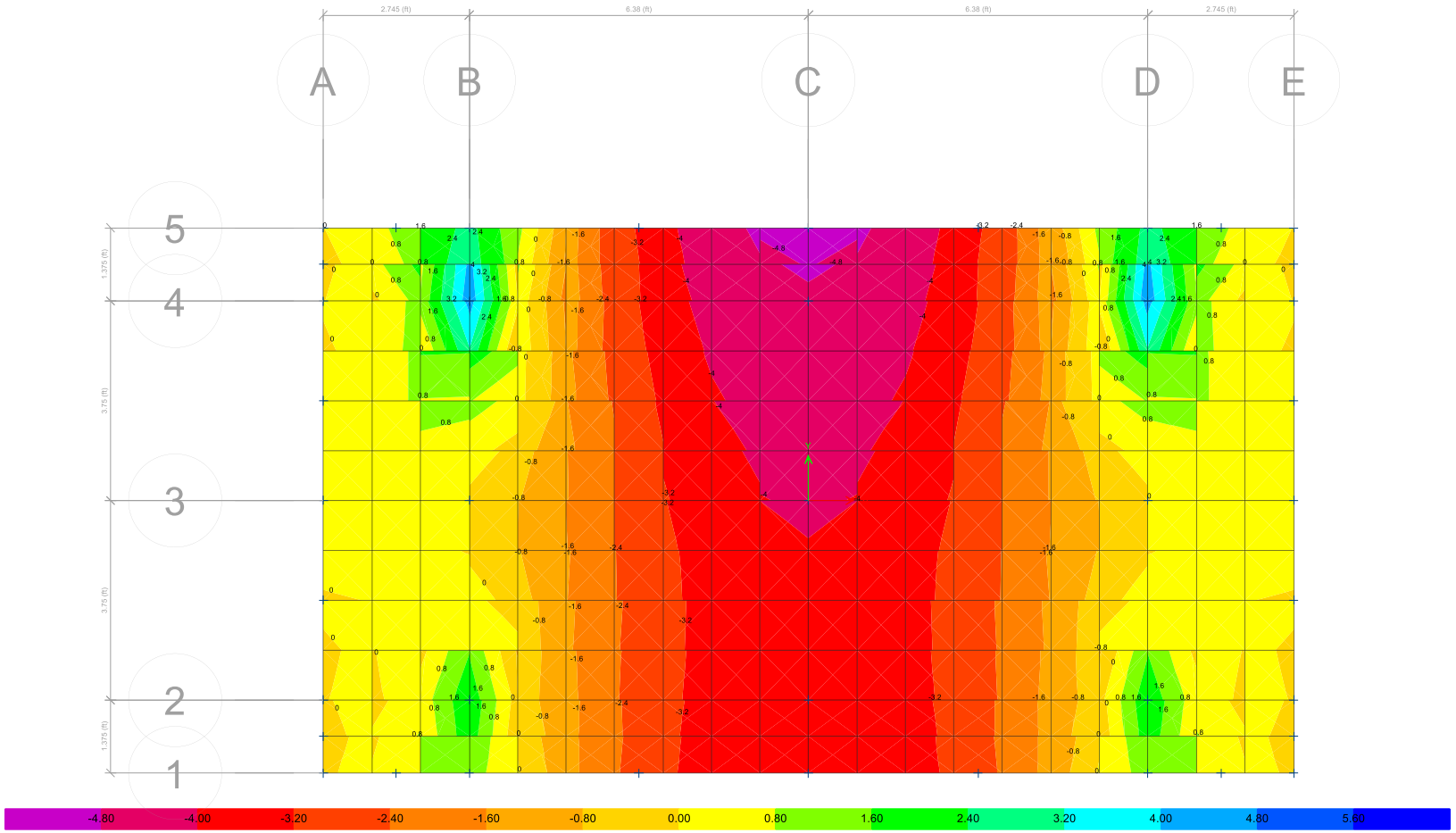
LOAD COMBINATION 4 – M11 (kip-ft/ft)



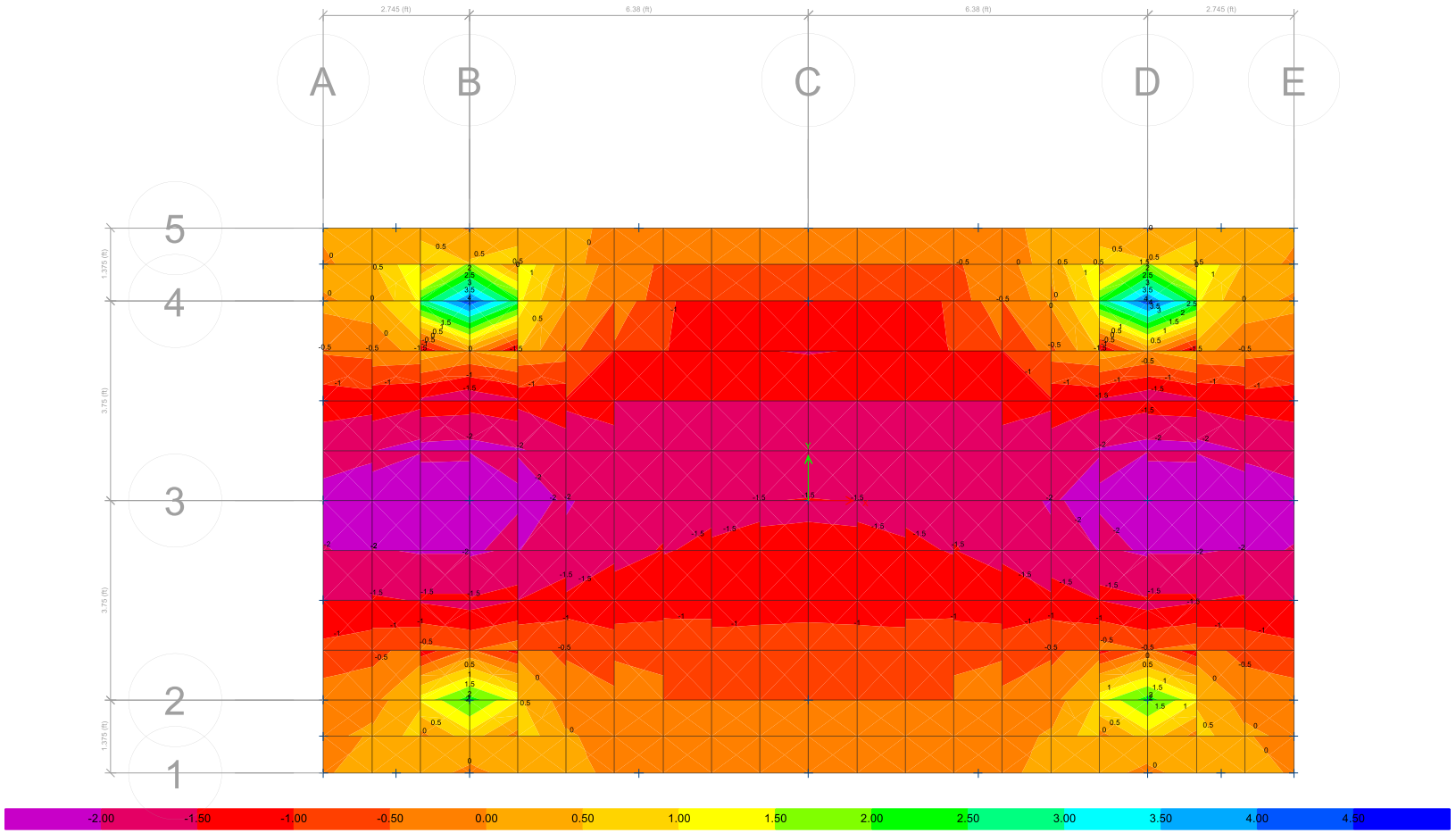
LOAD COMBINATION 4 – M22 (kip-ft/ft)



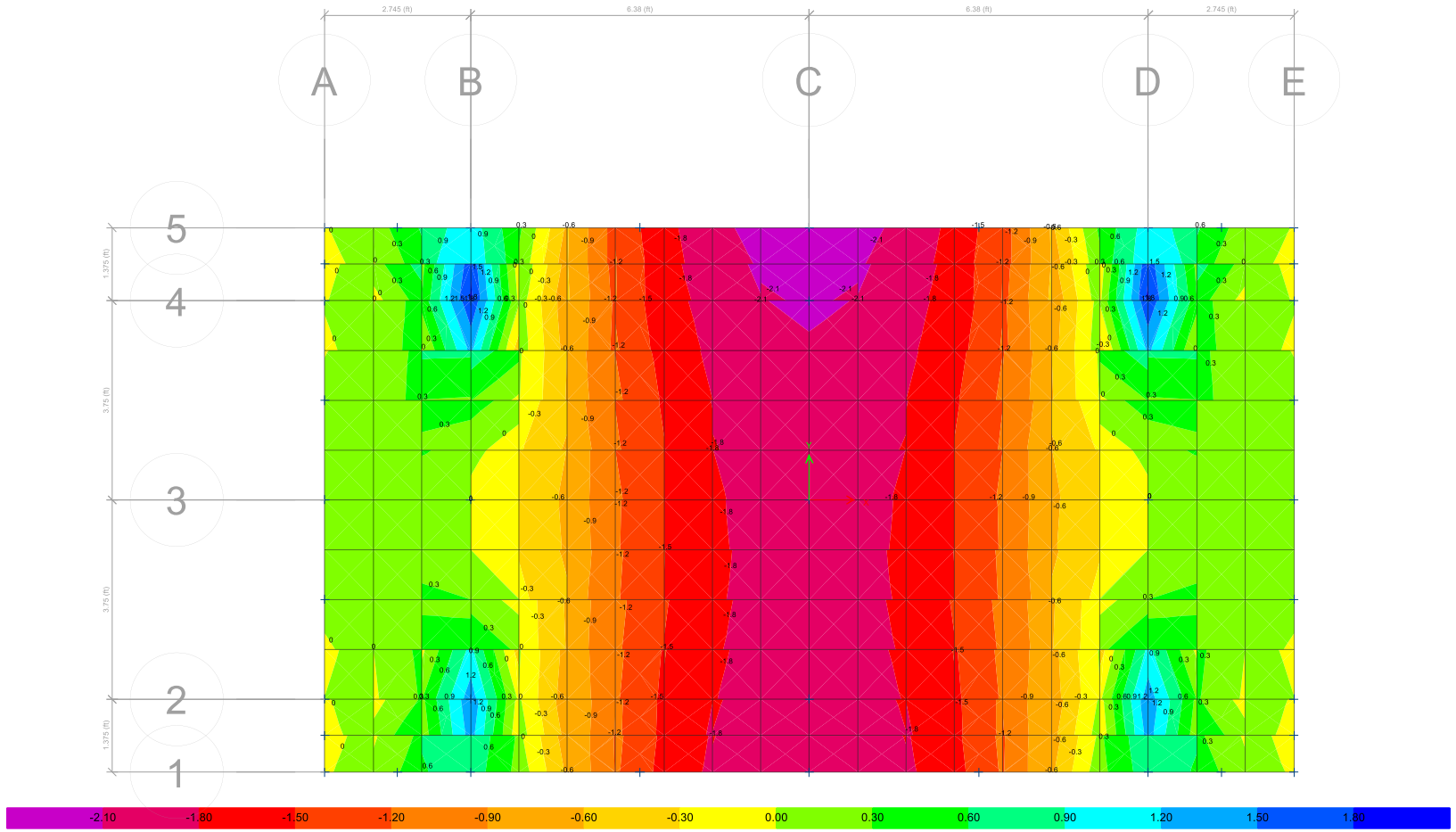
LOAD COMBINATION 5 – M11 (kip-ft/ft)



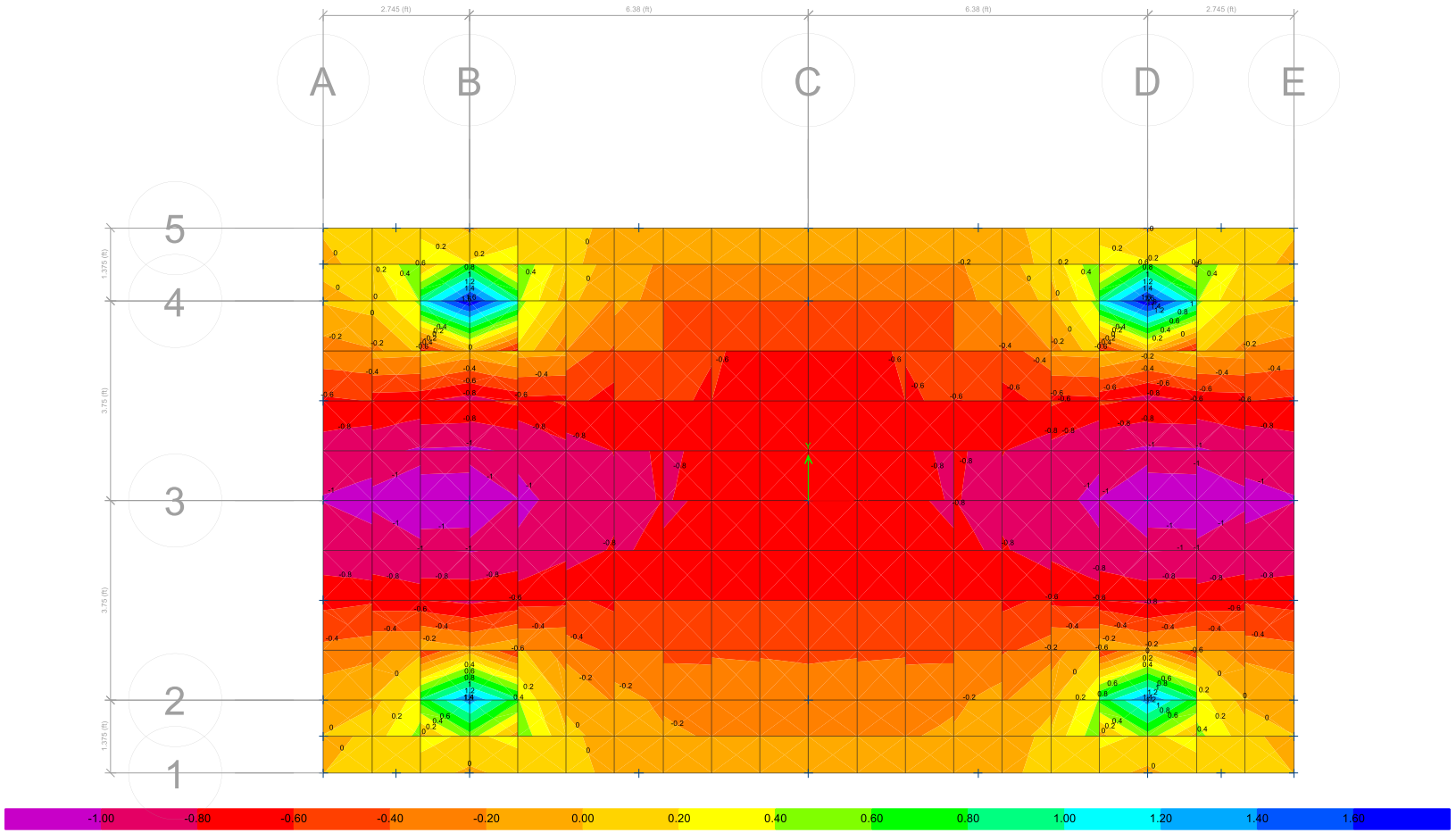
LOAD COMBINATION 5 – M22 (kip-ft/ft)



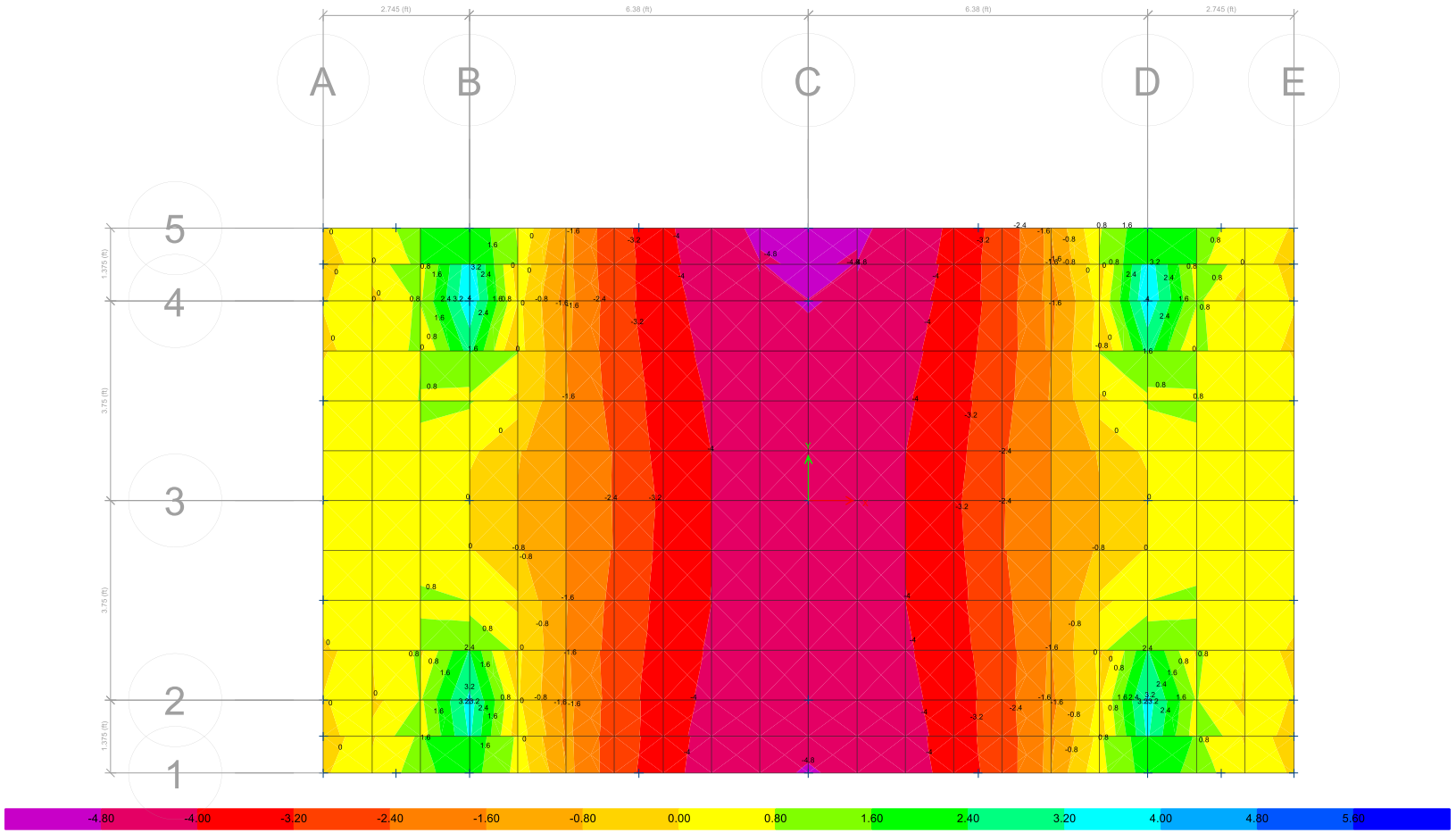
LOAD COMBINATION 6 – M11 (kip-ft/ft)



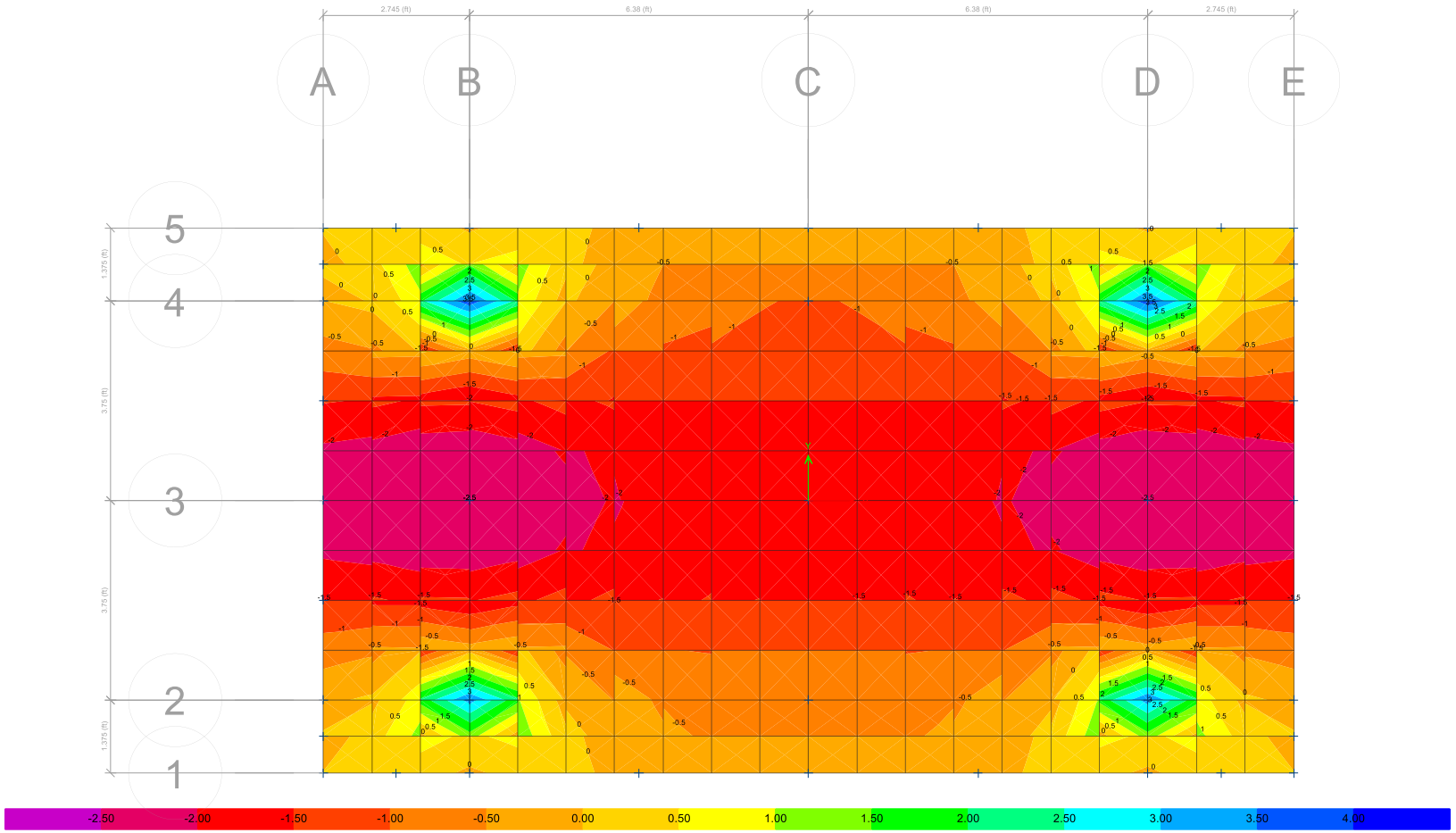
LOAD COMBINATION 6 – M22 (kip-ft/ft)



LOAD COMBINATION 7 – M11 (kip-ft/ft)



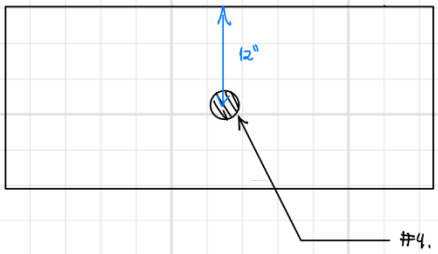
LOAD COMBINATION 7 – M22 (kip-ft/ft)



MOMENT CAPACITY OF PAD

Critical Moment on concrete Pad (per SAFE results)

$M_u = 5.24 \frac{kip\text{-}ft}{ft.}$



$A_s = 0.2 in^2$.

$a = \frac{f_y \cdot A_s}{0.85 f_c' \cdot b} = \frac{60 ksi \cdot 0.2 in^2}{0.85 \cdot 3 ksi \cdot 12 in} = 0.39 in.$

$\phi M_n = 0.9 \cdot 0.2 in^2 \cdot 60 \cdot \left(12 in - \frac{0.39}{2} in\right) = 127.494 kip\text{-}in = 10.62 \frac{kip\text{-}ft}{ft.}$

Demand-Capacity-Ratio: $DCR = \frac{M_u}{\phi M_n} = \frac{5.24}{10.62} = 49\%$ OK

Existing reinforcement is sufficient. Minimum Reinforcement $\rho = 0.0018$ is not satisfied.

Assuming the pad behaves as plain concrete:

$\phi M_n = 0.6 \cdot \min(5\sqrt{f_c'} \cdot S_m, 0.85 \cdot f_c' \cdot S_m)$

$= 0.6 \cdot 1 \cdot S_m \cdot \min(5\sqrt{f_c'}, 0.85 f_c')$

$= 0.6 \cdot 1 \cdot \frac{1}{6} \cdot 12^2 \cdot 24^2 \cdot \min(5\sqrt{3000}, 0.85 \cdot 3000)$

$= 691.2 in^3 \cdot \min(273.9 psi, 2550 psi)$

$= 189{,}319 \#\text{-}in$

$= 15.7$

Demand-Capacity-Ratio: $DCR = \frac{M_u}{\phi M_n} = \frac{5.24}{15.77} = 33\%$ OK

Pad can resist demands assuming it acts as plain concrete.