

Project Manual
Book 1 of 1

Electrical Early Equipment Package
Holmes Campus Ventilation Upgrades
KDE BG No. 23-066

2500 Madison Ave. / Covington, KY 41014

Covington Independent Public School District

25 E. 7th Street
Covington, KY 41011

Issued for Bidding: July, 2023



ARCHITECT:
PCA ARCHITECTURE, P.S.C.
906 Monmouth Street
Newport, KY 41071
Phone: (859) 431-8612

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Bid Documents

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- Noncollusion Affidavit-2013 (KDE)

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DRAWING LIST EXHIBIT A

ELECTRICAL

AD-E006 Electrical Singleline – New Work
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END OF EXHIBIT A – DRAWING LIST

EXHIBIT "B"

Bill To:

Covington Independent Board of Education

Covington Independent Public Schools
25 E. 7th Street
Covington, KY 41011

Attn: Accounts Payable
Phone: 859-392-1023
Fax: 859-292-5916



PURCHASE ORDER

202257389

Page: 1

Release Method: Hard Copy

Release Date: 05/31/2022

Fiscal Date: 05/25/2022

Need By Date: n/a

Print Date: 05/31/2022

Vendor:

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

Phone: [REDACTED]
Fax: [REDACTED]

Ship To:

[REDACTED]
[REDACTED]
[REDACTED]

See Delivery, Reference Below

Phone: 859-292-5895
Fax:

Purchase Order Comments:

Requisition Numbers: 58404

Vendor Item	QTY	UOM	Description	Unit Price	Total Price
[REDACTED]	1	Each	[REDACTED]	[REDACTED]	[REDACTED]
Deliver To: Zmurk, Rebecca					
				Sub Total: \$	[REDACTED]
				Shipping & Handling: \$.00
				Tax: \$.00
				Total: \$	[REDACTED]
Account Code Summary					
Account Code	Account Description				Amount
0102118-0610-3101					[REDACTED]

Terms and Conditions:

Covington Independent Public School's State Tax Exempt #C-360

It is hereby certified that the above amount required to meet the contract agreement obligation payment or expenditure for the above has been lawfully appropriated or authorized or directed for such purposes and is in the treasury or in process of collection to the credit of the Funds of the Board of Education free from any obligation or certification now outstanding.

Annette L. Burtachy

Director of Financial Services

INSTRUCTIONS TO VENDOR

- ALL CORRESPONDENCES INVOICES PHONE CALLS ETC MUST REFERENCE THE PURCHASE ORDER NUMBER ON THIS DOCUMENT

LEGAL NOTICE ADVERTISEMENT FOR PROPOSALS

Sealed bids for furnishing all materials and equipment necessary to complete the project:

Equipment Purchase
(Material Purchase Only – No Installation)
Holmes Campus Ventilation Upgrades
2500 Madison Ave. Covington, Kentucky 41014

For Covington Independent Public School District
25 E. 7TH Street Covington, Kentucky 41011
KDE BG NO. 23-066

will be received and time stamped by the Owner, Covington Independent Public School District, at the Board of Education Office reception desk, 25 East Seventh Street, Covington, Kentucky 41011 until, Tuesday July 25, 2023 at 2:00 PM, Eastern Standard Time.

The work will be performed under ONE purchase order with the Owner.

Bidders may download Bidding Documents as prepared by PCA Architecture^{PSC} from the Covington Independent Public Schools website at www.covington.kyschools.us starting Monday, July 10, 2023.

Statement of Purpose

The purpose of this document is to solicit proposals for supplying electrical switchgear for the Holmes Campus – Ventilation Upgrades. This proposal is for supplying the equipment only. No installation is included.

Acceptance of Proposal

Proposals will be received to the attention of Ken Kippenbrock, Representing Covington Independent Public Schools Board of Education, 25 E 7th Street, Covington KY 41011 until 2:00 p.m., July 25, 2023. Proposals shall be submitted in a sealed envelope clearly marked "Holmes Campus Ventilation Upgrades Bid." An representative of the firm who is authorized to legally bind the firm must sign the bid form.

All proposals which are in order and properly signed shall be opened and reviewed. No immediate decisions shall be rendered concerning the submitted proposals. All responses may be rejected at the discretion of the Covington Independent Public Schools. The Covington Independent Public Schools District reserves the right to choose the response that best suits the District's needs. This RFP in no way constitutes a contract or commitment to purchase.

If all responses are rejected, the Covington Independent Public Schools District reserves the right to publish an RFP at a later date. All proposals shall be effective for sixty (60) days from the date of opening unless otherwise specified in special conditions of bidding, and no bid may be withdrawn prior to that time.

All equipment must be 100% new and not used, remanufactured, or newly remanufactured.

Model Procurement Regulations

The Model Procurement Regulations adopted by the Board of Education shall be deemed incorporated by reference in these specifications as though fully quoted herein. In the event of any conflict between this invitation for proposal and the Model Procurement Regulations, the Regulations shall control.

Taxes

Federal excise taxes or Kentucky state sales, property tax and use taxes are not applicable to any purchase made for the Covington Independent Public Schools. Purchase exemption certificates will be furnished as required.

Additional Fees

Property Insurance Coverage should not be included in the bid. The Covington Independent Public School District has acquired the necessary coverage through the district's insurance company. A copy of the statement provided by the insurance company will be provided; upon request by the vendor selected.

Covington Independent Public Schools (CIPS) is issuing this RFP. The District Contact is the only person authorized to change, modify, amend, alter or clarify the specifications and terms and conditions of this RFP.

Non-discrimination

During the performance of this Contract, the Seller agrees as follows:

1. The Seller shall not discriminate against any employee, applicant, or subcontractor because of age, color, creed, handicap condition, marital or parental status, national origin, race, sex, veteran status, or political opinion or affiliation. The Seller shall take affirmative action to ensure that applicants are employed without regard to their age, color, creed, handicap condition, marital or parental status, national origin, race, sex, veteran status, or political opinion or affiliation. Such action shall include, although not limited to the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Seller agrees to post in conspicuous place notices setting forth the provisions of the Equal Opportunity clause.

2. The Seller shall in all solicitations and/or advertisements for employees placed by or on behalf of the Seller, state that all qualified applications shall receive consideration for employment with regard to age, color, creed, handicap condition, marital or parental status, national origin, race, sex, veteran status, or political opinion or affiliation.

3. The Seller shall cause any subcontractor engaged to perform any services required by this Contract to include this Equal Opportunity clause in all solicitations, advertisements and employment practices it shall perform.

RFP Questions

Our objective is to ensure that we provide you with all of the information you need in order for you to provide the most complete response to this RFP as possible. As such, we welcome any and all questions you might have.

Questions or requests for clarification must be emailed to: ken.kippenbrock@covington.kyschools.us. These questions and the answers to the questions will be distributed to all parties participating in the RFP process. Phone discussions will not be permitted so as to provide the same information for all vendors.

Important Dates

7/10/2023 - RFP is made available through email/website

7/25/2023 - Completed response to RFP due by 2:00 pm. Sealed packet should be delivered to District's Central Office (25 E 7th St Covington, KY 41011).

7/25/2023 Packets will be opened at District's Central Office. No decisions will be made at this time and no questions will be answered. A representative from each company that has submitted a bid, may be present for the bid opening.

TBD - District will announce RFP recipient

07/10/2024 – Delivery date of equipment

Contact Information

The District Contact named below shall be the sole point of contact throughout the procurement process. All communications, oral and written (regular mail, express mail, electronic mail, or fax), concerning this procurement, shall be addressed to:

Bids, including the Form of Proposal, Non-collusion Affidavit, and required Shop Drawing Submittal, should be submitted in an opaque sealed envelope with the outside clearly marked with the name of the Project and the name of the Bidder and should be addressed to:

Mr. Ken Kippenbrock
E: ken.kippenbrock@covington.kyschools.us
Representing Covington Independent Public Schools Board of Education
Covington Independent Public School District
25 East 7th Street
Covington, KY 41011

FACPAC Purchase Order Form

Form Status:

Tier 2 Project:

BG Number:

Status: Active

District:

Phase: Project Initiation (View Checklist)

Contract:

Type: General Contractor

Proposed

District PO Number

Ky Sales Tax Exempt Number

Date of Order

Specification Section

Material Description / Category

Requested By

Vendor Name

Vendor Address

Vendor Phone

Vendor Email

Bill To

Bill To Address

Ship To

Ship To Address

Attention Of

Contacts

The following project contacts must be notified 48 hours in advance of delivery to jobsite.

Contact Name

Contact Phone

Materials

Furnish the necessary materials to complete the following bid package(s) / specification section(s) in its entirety. All materials shall be in accordance with the requirements of the Contract.

Item Description

Item
Number

Quantity

Unit Price

Total

Purchase Order Total:

Authorization

Owner Authorization Date

Vendor Authorization Date

Purchase Order Signature Page

Vendor

Date

Owner

Date

Terms and Conditions

1. Drawings, catalogs, cut sheets, or samples shall be submitted for approval.
2. All invoices shall be sent to the contractor/subcontractor designated on the purchase order for approval. No invoices shall be sent directly to the Board of Education (Owner) for payment.
3. All invoices shall reference the purchase order number.
4. No change in, modification of, or revision of this order shall be valid unless in writing and signed by the Owner.
5. Vendor agrees to observe and comply with all applicable federal, state and locals laws, rules, ordinances and regulations in performance of this order.
6. Vendor shall not assign this order or any right hereunder without first having obtained the written consent of the Owner.
7. Deliveries are to be made in accordance with the Owner's schedule, as directed by the General Contractor (GC), Construction Manager (CM) or Qualified Provider (QP).
8. The Owner may cancel this purchase order in whole or in part in the event that the vendor fails or refuses to deliver any of the items purchased, within the time provided, or otherwise violates any of the conditions of this purchase order, or if it becomes evident that the vendor is not providing materials in accordance with the specifications or with such diligence as to permit delivery on or before the delivery date.
9. The vendor agrees to deliver the items to the supplied hereunder free and clear of all liens, encumbrances and claims.
10. If any of the goods covered under this purchase order are found to be defective in material or workmanship, or otherwise not in conformity with the requirements of this order, the Owner, in addition to the other rights which it may have under warranty or otherwise, shall have the right to reject the same or require that such articles or materials be corrected or replaced promptly with satisfactory materials or workmanship.
11. By acknowledging receipt of this order, by performing the designated work or any portion thereof, or by shipping the designated goods, the vendor agrees to the terms and conditions outlined.
12. This purchase order shall be governed in all respects by the laws of the Commonwealth of Kentucky.

13. In the event the quantities of materials supplied via this purchase order are insufficient to complete the work, the GC, CM or QP shall, at no expense to the Owner, provide such materials as necessary to complete the work.
14. In the event that at the completion of the work the vendor has not submitted invoices totaling the value of this purchase order, this purchase order shall be considered complete and closed.

DOCUMENT 004113 - BID FORM - STIPULATED SUM (Supplier Only Material Purchase Order)

1.1 BID INFORMATION

A. Vendor / Material Supplier:

_____.

B. Project Name: Electrical Early Equipment Package – Holmes Campus Ventilation Upgrades.

C. Project Location: Holmes High School – Administration Building / 2500 Madison Ave. / Covington, KY 41014.

D. Owner: Covington Independent Public School District.

E. Architect: PCA Architecture / 906 Monmouth Street / Newport, KY 41071 / (859) 431-8612.

F. Architect Project Number: 22-090.

1.2 CERTIFICATIONS AND BASE BID

A. Base Bid, Supplier Only Material Purchase Order: The undersigned Bidder, having carefully examined the Procurement and Contracting Requirements, Conditions of the Purchase Order, Drawings, Specifications, and all subsequent Addenda, as prepared by PCA Architecture and Architect's consultants, and being familiar with all conditions and requirements of the Work, hereby agrees to furnish the material and equipment for the above-named project, according to the requirements of the Procurement and Contracting Documents, for the stipulated sum of:

1. (Use Words): _____

(Use Numbers) (\$_____).

1.3 BID GUARANTEE

A. None Required.

1.4 EQUIPMENT DELIVERY DATE

A. The undersigned Vendor / Material Supplier proposes a material / equipment delivery date of _____, 2024
(no later than July 10, 2024).

1.5 ACKNOWLEDGEMENT OF ADDENDA

A. The undersigned Bidder acknowledges receipt of and use of the following Addenda in the preparation of this Bid:

1. Addendum No. _____ (Insert the addendum numbers received or the word 'none' if no addendum received).

1.6 BID SUPPLEMENTS

A. The following supplements are a part of this Bid Form and shall be attached hereto.

1. Shop Drawings.

1.7 SUBMISSION OF BID

A. Respectfully submitted this _____ day of _____, 2023.

B. Submitted By: _____
(Name of Vendor / Material Supplier).

C. Authorized Representative Name: _____
(Type or print name).

D. Authorized Representative Signature: _____
(Signature).

E. Authorized Representative Title: _____
(Title).

F. Street Address: _____.

G. City, State, Zip: _____.

H. Phone: _____.

I. Federal ID No.: _____.

END OF DOCUMENT 004113

The undersigned agent, being duly sworn, states that neither he/she nor his/her firm has any relationship (financial or through kinship) to:

- ☐ Any school board member or the superintendent;
- ☐ Any or all prime contractors or material suppliers when using the construction management method of construction.

The undersigned further states that he/she has not entered into any agreement or collusion with any person relative to the price bid by anyone nor has he/she attempted to induce anyone to refrain from bidding.

Explain below any kinship or financial relationship you may have to any parties as mentioned above on this project.

This affidavit is subject to KRS 45A.455 prohibition against conflict of interest, and gratuities and kickbacks.

Name	Title
------	-------

Name of Company

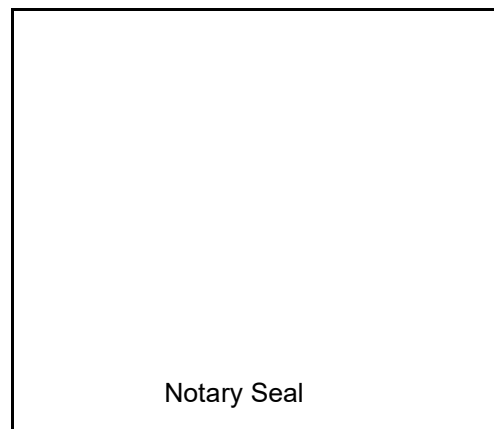
Subscribed and Sworn to Me this

_____ day of _____,
20_____.

Notary Signature

My Commission expires:

_____, 20_____.



SECTION 011000 - SUMMARY

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:
 - 1. Project information.
 - 2. Work covered by Contract Documents.
 - 3. Schedule
 - 4. Work under Owner's separate contracts.
 - 5. Purchase contracts.
 - 6. Access to site.
 - 7. Miscellaneous provisions.

1.3 PROJECT INFORMATION

- A. Project Identification: Electrical Early Equipment Package - Holmes Campus Ventilation Upgrades.
 - 1. Project Location:
 - a. Holmes High School – Administration Building / 2500 Madison Ave. / Covington, KY 41014.
- B. Owner: Covington Independent Public School District / 25 East Seventh Street / Covington, KY 41011.
 - 1. Owner's Representative: Mr. Ken Kippenbrock, Executive Director Human Resources and Operations / ken.kippenbrock@covington.kyschools.us / (859) 392-1015.
- C. Architect: PCA Architecture / 906 Monmouth Street / Newport, Kentucky 41071 / (859) 431-8612
 - 1. Contact: Mr. Ralph Cooper / rcooper@pca-arch.com.
- D. Architect's Consultants: Architect has retained the following design professionals who have prepared designated portions of the Contract Documents:
 - 1. Consulting MEP Engineer: CMTA / 1100 Sycamore St., Suite 400 / Cincinnati, Ohio 45202 / Phone (513) 429-4404
 - a. Contact: Mr. Jeff Millard / jmillard@cmta.com.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and consists of the following:

1. Provide all necessary equipment, shop drawings, and freight charges as shown or implied by the Contract Documents.
2. The terms 'summary of work', 'scope of work', and 'project scope' shall be used interchangeably.

B. Type of Contract:

1. Supplier Only Material Purchase Order.

1.5 SCHEDULE

- A. The Contractor's construction schedule will be available to material suppliers well in advance of the dates indicated below and will include the dates as indicated unless changes in dates are agreed to by the Owner, material supplier, and Contractor.

1. Delivery Date: Established by material supplier on bid form, but no later than July 10, 2024
2. Start of Electric Service Shutdown for Switch-over: July 24, 2024.
3. Substantial Completion: August 14, 2024 (start of material / manufacturer warranty).

1.6 WORK UNDER OWNER'S SEPARATE CONTRACTS

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

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

1. Single Prime Construction Contract: For Holmes Campus Ventilation Upgrades.

The equipment in this bid package is being ordered by the school district. As of the bid date for this equipment purchase scope of work, bidders are to assume delivery of equipment to a yet to be determined Electrical Subcontractor's yard located within 75 miles of Cincinnati, Ohio. By the time actual delivery is to occur, the General Contractor (Future Contractor) and Electrical Subcontractor for the project requiring this equipment will be known and actual delivery arrangements can be made.

1.7 PURCHASE ORDERS AND SALES TAX

- A. General: As provided by KRS 139.310 and Kentucky Administrative Regulation 103 KAR 26:070 (Contact Construction), each contractor is responsible for Kentucky Sales and Use Tax on all materials purchased and installed by the contractor or a third party hired by the contractor. For those bid packages identified as Supplier Only or Contractor/Supplier (containing bid breakout items), the sales and use tax is to be excluded only on those material items purchased by the Owner directly from the material supplier.

- B. Future Contractor(s) shall cooperate with Owner by allowing direct purchase of materials by the Owner and Owner's tax exempt status.

- C. The Vendor / Material Supplier shall list on the Form of Proposal those items to be purchased directly by the Owner with a Purchase Order to be issued by the Owner to the individual supplier(s).

1. Pre Bid

- a. Terms/Conditions of Covington Independent Public Schools' Purchase Order is non-negotiable and shall be direct with the Covington Independent Public Schools Board of Education.
- b. Vendor/Material Supplier verifies acceptability of the materials with contract documents.
- c. Bidder verifies quantity to complete the project. All materials required beyond the amount of the Purchase Order shall be the responsibility of the Future Contractor.

2. Post Bid

- a. Owner will issue a Purchase Order.
- b. Vendor/Material Supplier will return signed Purchase Order with completed W-9 to Owner via Bidder.

3. Bidder Conditions

- a. Vendor/Material Supplier shall be responsible for material lead times per the project schedule.
- b. Future Contractor to be responsible for delivery terms, accepting/unloading and verifying material condition and quantity.
- c. Future Contractor's bond shall cover the full bid amount including the total value of owner purchased materials. Bid and Payment and Performance bonds are required of Future Contractor.
- d. Invoices from Suppliers shall be paid in full. No down payments or advance payments will be made.
- e. Invoices shall be paid on the same monthly billing cycle as Future Contractor's pay requests.
- f. Future Contractor shall coordinate all deliveries and provide copies of all delivery tickets to the Owner's representative.
- g. Future Contractor shall provide all materials required beyond the Purchase Order as required to complete the Work.
- h. Future Contractor accepts all responsibilities for installation of materials obtained through purchase orders in the timely execution of the project. The purpose of Owner purchased items is to allow the Owner benefit from its tax exempt status and to facilitate the schedule of the Single Prime Construction Contract Project that will utilize these materials.
- i. The unused value associated with an Owner material purchase order remains with the Owner.

4. Pre Award: The Owner reserves the right to interview the three apparent low bidders for compliance with the bidding requirements outlined above and elsewhere in these documents and also for understanding of the bidding documents.

1.8 ACCESS TO SITE

- A. General: Material Supplier shall have limited use of Project site for material delivery.
- B. Use of Site: Limit use of Project site to the delivery and storage location. Do not disturb portions of Project site beyond areas agreed to by the Owner.

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

- a. Schedule deliveries to minimize use of driveways and entrances.

1.9 MISCELLANEOUS PROVISIONS

A. Shop Drawings.

1. Providing the various submittals requested throughout the contract documents shall be the sole responsibility of the material supplier. **Submission of Shop Drawings is required with the Bid.**

B. **THIS PROJECT UTILIZES FEDERAL FUNDS.** Vendor shall adhere to all applicable laws and regulations.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

DIVISION 26 – ELECTRICAL

SECTION 262200 – DRY-TYPE LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The Contractor is directed to examine each and every section of these specifications, all drawings relating to the Contract Documents, any and all Addenda, etc., for work described elsewhere that may relate to the provision of the work described herein. Materials and performance requirements are specified elsewhere herein that relate to these systems.
- C. Each Electrical Contractor's attention is directed to Section 260501 - General Provisions, Electrical, and all other Contract Documents as they apply to his work.

1.2 SUMMARY

- A. This Section includes the following types of dry-type distribution transformers and dry-type shielded isolation transformers rated 600 V and less, with capacities up to 1000 kVA.

1.3 REFERENCES

- A. NFPA 70 - National Electrical Code
- B. NEMA ST20
- C. Underwriters Laboratory (UL) and Canadian Standard Association
 - 1. UL 1561 – Dry-Type General Purpose and Power Transformers
 - 2. CSA C22.2 No.47-M90 Air-Cooled Transformer (Dry Type)
- D. UL 250 Enclosure for Electrical Equipment
- E. Transformers shall meet the minimum efficiency requirements per DOE 10 CFR Part 431 Energy Conservation program for Commercial Equipment, effective 2016.
- F. 2005 Energy Act PUBLIC LAW 109–58—AUG. 8, 2005 Comply with all Rules from Department of Energy
 - 1. 10 CFR 429
 - 2. 10 CFR 431

1.4 STANDARDS

- A. Transformers shall be listed by Underwriters Laboratories.
- B. Conform to the requirements of ANSI/NFPA 70.
- C. Transformers are to be manufactured and tested in accordance with NEMA ST20.
- D. Minimum Efficiencies per DOE 10 CFR 431.192 April 2013. Transformers shall comply with the requirements of being built after January 1, 2016. The efficiency of low-voltage dry-type distribution transformer shall be no less than that required for their kVA rating as listed below. Efficiency values are at 35% of nameplate rated load, determined according to the DOE Test Method for Measuring the Energy Consumption of Distribution Transformers under Appendix A to Subpart K of 10 CFR part 431. Low-voltage dry-type distribution transformers with kVA ratings not appearing below shall have their minimum efficiency level determined by linear interpolation of the kVA and efficiency values immediately above and below that kVA rating.
 - 1. Single Phase Low-Voltage Dry-Type Distribution Transformers

- | | | |
|----|---------|------------------|
| a. | 15kVA | 97.70% Efficient |
| b. | 25kVA | 98.00% Efficient |
| c. | 37.5kVA | 98.20% Efficient |
| d. | 50kVA | 98.30% Efficient |
| e. | 75kVA | 98.50% Efficient |
| f. | 100kVA | 98.60% Efficient |
| g. | 167kVA | 98.70% Efficient |
| h. | 250kVA | 98.02% Efficient |
| i. | 333kVA | 98.90% Efficient |

2. Three Phase Low-Voltage Dry-Type Distribution Transformers

- | | | |
|----|----------|------------------|
| a. | 15kVA | 97.89% Efficient |
| b. | 25kVA | 98.23% Efficient |
| c. | 45kVA | 98.40% Efficient |
| d. | 75kVA | 98.60% Efficient |
| e. | 112.5kVA | 98.74% Efficient |
| f. | 150kVA | 98.83% Efficient |
| g. | 225kVA | 98.94% Efficient |
| h. | 300kVA | 99.02% Efficient |
| i. | 500kVA | 99.14% Efficient |
| j. | 750kVA | 99.23% Efficient |
| k. | 1000kVA | 99.28% Efficient |

1.5 ACTION SUBMITTALS

- A. Product Data: Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated. Shall include the following:
1. Confirmation that transformer(s) are UL 1561 Listed with a K-9 Rating.
 2. Basic Performance characteristics including insulation class, temperature rise, core and coil materials, impedances & audible noise level, unit weight, inrush data RMS.
 3. Efficiency Data
 4. No load and full load losses will be calculated per NEMA ST20 test methods.
 5. Efficiency Curves
 - a. Linear Loads
 - b. Data per the non-linear load test program.
- 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. Wire Access Points
 3. Wire Bending Dimensions
 4. Location for Ground Lug Provisions

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Source quality-control test reports.
- C. Field quality-control test reports.

1.7 CLOSEOUT SUBMITTALS

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

1.8 QUALITY ASSURANCE

- A. Source Limitations: Obtain each transformer type through one source from a single manufacturer.
- B. 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.
- C. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

1.9 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.

1.10 COORDINATION

- 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 with concrete.
- B. Coordinate installation of wall-mounting and structure-hanging supports with actual transformer provided.

1.11 WARRANTY

- A. The equipment items shall be supported by service organizations which are reasonably convenient (less than 100 miles from project site) to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.
- B. All dry-type low-voltage transformers, finishes, and all of its component parts, and controls shall have an unconditional one (1) year warranty. Warranty shall include finishes and all components to be free from defects in materials and workmanship for a period of one (1) year from date of Owner's acceptance. Replacement of dry-type low-voltage transformers, faulty materials and the cost of labor to make the replacement shall be the responsibility of the Contractor.
- C. The Warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under provisions of the Contract Documents and shall be in addition to, and run concurrently with other warranties made by the Contractor under requirements of the Contract Documents.

1.12 SYSTEM COMMISSIONING

- A. Section 019113 requires the engagement of a Commissioning Authority to document the completion of the Mechanical, Fire Protection, Plumbing, Electrical, Electronic Safety and Security, and associated Control Systems for the project. Section 019113 defines the roles and responsibilities of each member of the commissioning team.
- B. Comply with the requirements of Section 019113 for the commissioning of the various building systems.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Square D.
 - 2. Eaton Electrical Inc.; Cutler-Hammer Products.
 - 3. General Electric Company.
 - 4. Siemens.
 - 5. ABB.
- B. Manufacturers shall be registered firms in accordance with ISO 9001:1994 SIC 3612 (US); which is the design and manufacture of low voltage dry type power, distribution and specialty transformers.

2.2 GENERAL TRANSFORMER REQUIREMENTS

- A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.
- B. Cores: Grain-oriented, non-aging silicon steel.
- C. Coils: Continuous windings without splices except for taps.
 - 1. Internal Coil Connections: Brazed or pressure type.
 - 2. Coil Material: Copper.
- D. The transformer enclosures shall be ventilated and be fabricated of heavy gauge, sheet steel construction. The entire enclosure shall be finished utilizing a continuous process consisting of degeasing, cleaning and phosphatizing, followed by electrostatic deposition of polymer polyester powder coating and baking cycle to provide uniform coating of all edges and surfaces. The coating shall be UL recognized for outdoor use.
 - 1. 1" Minimum Clearance from Rear and Sides
- E. The core of the transformer shall be visibly grounded to the enclosure by means of a flexible grounding conductor sized in accordance with applicable UL and NEC standards.
- F. Comply with NEMA ST 20, and list and label as complying with UL 1561.
- G. Cores: One leg per phase.
- H. Enclosure: Ventilated, NEMA 250, Type 2.
 - 1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
- I. Transformer Enclosure Finish: Comply with NEMA 250.
 - 1. Finish Color: Gray.
- J. Taps shall have a 5% FCAN and 10% FCBN
 - 1. 2.5% Steps On all voltages 350 V and above
 - a. 15 to 225kVA
 - b. 300kVA
 - 1) 150°C Rise
 - 2) 80°C Rise change to 5% FCBN instead of 10%
 - c. 500 and 750kVA range change to 5% FCBN instead of 10%
 - d. 1000kVA and greater per Manufacture Design
 - 2. 5% Steps On all voltages below 350 V
 - a. 15 to 225kVA
 - b. 300kVA
 - 1) 150°C Rise
 - 2) 80°C Rise change to 5% FCBN instead of 10%
 - c. 500 and 750kVA range change to 5% FCBN instead of 10%
 - d. 1000kVA and greater per Manufacture Design
- K. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 115 deg C rise above 40 deg C ambient temperature.
- L. Energy Efficiency for Transformers Rated 15 kVA and Larger:
 - 1. Complying with NEMA TP 1, Class 1 efficiency levels.
 - 2. Tested according to NEMA TP 2.

- M. K-Factor Rating: Transformers indicated to be K-factor rated shall comply with UL 1561 requirements for non-sinusoidal load current-handling capability to the degree defined by designated K-factor.
 - 1. Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor.
 - 2. Indicate value of K-factor on transformer nameplate.
 - N. Wall Brackets: Manufacturer's standard brackets.
 - O. Low-Sound-Level Requirements: Minimum of 3 dBA less than NEMA ST 20 standard sound levels when factory tested according to IEEE C57.12.91.
- 2.3 Sound levels shall be warranted by the manufacturer not to exceed the following:
- 1. 15to 50KVA - 39dB
 - 2. 51 to 150kVA - 44dB
 - 3. 151 to 300kVA - 49dB
 - 4. 301 to 500kVA - 54dB
 - 5. 501 to 700kVA - 56dB
 - 6. 701 to 1000kVA - 58dB
- 2.4 IDENTIFICATION DEVICES
- A. Nameplates: Engraved, laminated-plastic or metal nameplate for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260553.
- 2.5 SOURCE QUALITY CONTROL
- A. Test and inspect transformers according to IEEE C57.12.91.
 - B. Factory Sound-Level Tests: Conduct sound-level tests on equipment for this Project.

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 Section 260526 "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 wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.
- B. Construct concrete bases and anchor floor-mounting transformers according to manufacturer's written instructions.

3.3 CONNECTIONS

- A. Ground equipment according to Section 260526.
- B. Connect wiring according to Section 260519.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Tests and Inspections: 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.
- D. Infrared Scanning: Two months after Substantial Completion, perform an infrared scan of transformer connections.
 - 1. Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
- E. Perform 2 follow-up infrared scans of transformers, one at 4 months and the other at 11 months after Substantial Completion.
- F. Prepare a certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.
- G. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.5 QUALITY CONTROL/STARTUP:

- A. Major equipment and system startup and operational tests shall be scheduled and documented in accordance with Section 019113 Commissioning.

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.
- B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.7 CLEANING: Vacuum dirt and debris; do not use compressed air to assist in cleaning.

3.8 DEMONSTRATION AND TRAINING

- A. Training of the owner's operation and maintenance personnel is required in cooperation with the Commissioning Authority. The instruction shall be scheduled in coordination with the Commissioning Authority after submission and approval of formal training plans. Refer to Section 019113 and the Commissioning Plan for further contractor training requirements.

END OF SECTION

DIVISION 26 – ELECTRICAL

SECTION 262413 – LOW-VOLTAGE SWITCHBOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The Contractor is directed to examine each and every section of these specifications, all drawings relating to the Contract Documents, any and all Addenda, etc., for work described elsewhere that may relate to the provision of the work described herein. Materials and performance requirements are specified elsewhere herein that relate to these systems.
- C. Each Electrical Contractor's attention is directed to Section 260501 - General Provisions, Electrical, and all other Contract Documents as they apply to his work.

1.2 SUMMARY

- A. Section Includes:
 - 1. Service and distribution Switchboards rated 600 V and less.
 - 2. Transient voltage suppression devices.
 - 3. Disconnecting and overcurrent protective devices.
 - 4. Instrumentation.
 - 5. Accessory components and features.
 - 6. Identification.
- B. Manufacturer shall provide Start-up Services for all Switchboards. Electrical Contractor shall schedule and complete the start-up services two (2) weeks prior to the switchboards being energized.

1.3 REFERENCES

- A. The switchboard(s) and overcurrent protection devices referenced herein are designed and manufactured according to the following appropriate specifications.
 - 1. ANSI/NFPA 70 - National Electrical Code (NEC).
 - 2. ANSI/IEEE C12.16 - Solid-State Electricity Metering.
 - 3. ANSI C57.13 - Instrument Transformers.
 - 4. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.
 - 5. NEMA PB 2 - Deadfront Distribution Switchboards, File E8681
 - 6. NEMA PB 2.1 - Proper Handling, Installation, Operation and Maintenance of Deadfront Switchboards Rated 600 Volts or Less.
 - 7. NEMA PB 2.2 - Application Guide for Ground Fault Protective Devices for Equipment.
 - 8. UL 50 - Cabinets and Boxes.
 - 9. UL 98 - Enclosed and Dead Front Switches.
 - 10. UL 489 - Molded Case Circuit Breakers.
 - 11. UL 891 - Dead-Front Switchboards.
 - 12. UL 943 - Standard for Ground Fault Circuit Interrupters.
 - 13. Federal Specification W-C-375B/Gen - Circuit Breakers, Molded Case, Branch Circuit and Service.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of Switchboard, overcurrent protective device, transient voltage suppression device, ground-fault protector, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

- B. Shop Drawings: For each Switchboard and related equipment.
1. Include dimensioned plans, front and side elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
 2. Conduit entrance locations and requirements; nameplate legends; one-line riser diagrams; equipment schedule; and switchboard instrument details.
 3. Detail enclosure types for types other than NEMA 250, Type 1.
 4. Detail bus configuration, current, and voltage ratings.
 5. Detail short-circuit current rating of Switchboards and overcurrent protective devices.
 6. Include descriptive documentation of optional barriers specified for electrical insulation and isolation.
 7. Detail utility company's metering provisions with indication of approval by utility company.
 8. Include evidence of NRTL listing for series rating of installed devices.
 9. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 10. Include time-current coordination curves for each type and rating of overcurrent protective device included in Switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.
 11. Include schematic and wiring diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. 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.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For Switchboards and components to include in emergency, operation, and maintenance manuals. 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 coordination curves for each type and rating of overcurrent protective device included in Switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Potential Transformer Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
 2. Control-Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
 3. Indicating Lights: Equal to 10 percent of quantity installed for each size and type, but no fewer than one of each size and type.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E.

- B. Source Limitations: Obtain Switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- C. Product Selection for Restricted Space: Drawings indicate space available for Switchboards including clearances between Switchboards and adjacent surfaces and other items. Equipment installed must meet all clearance, access and replacement working space requirements of the NEC and Owner.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. Comply with NEMA PB 2.
- F. Comply with NFPA 70.
- G. Comply with UL 891.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver Switchboards in sections or lengths that can be moved past obstructions in delivery path.
- B. Handle and prepare Switchboards for installation according to NECA 400 and NEMA PB 2.1. Lift only by lifting means provided for this express purpose. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.
- C. Deliver, store, protect, and handle products in conformance with manufacturer's recommended practices as outlined in applicable Installation and Maintenance Manuals.
- D. Each switchboard section shall be delivered in individual shipping splits for ease of handling. They shall be individually wrapped for protection and mounted on shipping skids.
- E. Accept equipment on site and inspect and report concealed damage to carrier within their required time period.
- F. Store in a clean, dry space. Maintain factory protection and/or provide an additional heavy canvas or heavy plastic cover to protect structure from dirt, water, construction debris, and traffic. Where applicable, provide adequate heating within enclosures to prevent condensation.

1.10 PROJECT CONDITIONS

- A. Product Selection for Restricted Space: Drawings indicate space available for switchgear, including clearances between switchgear and adjacent surfaces and other items. Equipment installed must make all clearance, access and replacement working space requirements of the NEC and Owner.
- B. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving Switchboards into place.
- C. Environmental Limitations:
 - 1. Do not deliver or install Switchboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above Switchboards 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 exceeding 104 deg F (40 deg C).
 - b. Altitude: Not exceeding 6600 feet (2000 m).
- D. 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 Construction Manager no fewer than 14 days in advance of proposed interruption of electric service.

2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Construction Manager's written permission.
4. Comply with NFPA 70E.

1.11 COORDINATION

- A. Coordinate layout and installation of Switchboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.12 WARRANTY

- A. The equipment items shall be supported by service organizations which are reasonably convenient (less than 100 miles from project site) to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.
- B. All low-voltage switchboards, finishes, and all of its component parts, and controls shall have an unconditional one (1) year warranty. Warranty shall include finishes and all components to be free from defects in materials and workmanship for a period of one (1) year from date of Owner's acceptance. Replacement of low-voltage switchboards, faulty materials and the cost of labor to make the replacement shall be the responsibility of the Contractor.
- C. The Warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under provisions of the Contract Documents and shall be in addition to, and run concurrently with other warranties made by the Contractor under requirements of the Contract Documents.
- D. Manufacturer's Warranty: Manufacturer agrees to replace or replace SPDs that fail in materials or workmanship within specified warranty period.
 1. Warranty Period: All surge suppression equipment shall be unconditionally warranted by the Contractor for a period of ten years from the date of substantial completion. If longer manufacturer's warranties are offered, they shall be made available to the Owner. Note these extended warranties in the Operations and Maintenance Manuals.
- E. SYSTEM COMMISSIONING
- F. Section 019113 requires the engagement of a Commissioning Authority to document the completion of the Mechanical, Fire Protection, Plumbing, Electrical, Electronic Safety and Security, and associated Control Systems for the project. Section 019113 defines the roles and responsibilities of each member of the commissioning team.
- G. Comply with the requirements of Section 019113 for the commissioning of the various building systems.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Square D; a brand of Schneider Electric.
 2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 4. Siemens.
 5. ABB
- B. Switchboards shall be service entrance labeled and listed by UL.

- C. The manufacturer of the switchboard shall be the same as the manufacturer of the circuit breakers or the switches mounted in the switchboard.
- D. All new panelboards, distribution panelboards and switchboards on this project shall be by the same manufacture as the switchboard for the purposes of stocking common breaker types, series ratings, etc.
- E. Indoor Enclosure: Steel, NEMA 250, Type 1 - General Purpose.
 - 1. Sections shall be aligned front and rear.
 - 2. Removable steel base channels (1.5 inch floor sills) shall be bolted to the frame to rigidly support the entire shipping section for moving on rollers and floor mounting.
 - 3. The switchboard enclosure shall be painted on all surfaces. The paint finish shall be a medium gray, ANSI #49, applied by the electro-deposition process over an iron phosphate pre-treatment.
 - 4. All front covers shall be screw removable with a single tool and all doors shall be hinged with removable hinge pins.
 - 5. Top and bottom conduit areas shall be clearly indicated on shop drawings.
- F. Short Circuit Current Rating: Switchboards shall be rated with a minimum short circuit current rating of 100,000 AIC, unless otherwise indicated on Power Distribution Riser Diagram.
- G. Nominal System Voltage: As indicated on Power Distribution Riser.
- H. Main-Bus Continuous: As indicated on Power Distribution Riser.
- I. Bus Composition: Shall be silver plated, hard-drawn copper of 98% conductivity. Plating shall be applied continuously to all bus work. The switchboard bussing shall be of sufficient cross-sectional area to meet UL Standard 891 temperature rise requirements. The phase and neutral through-bus shall have an ampacity as shown in the plans. For 4-wire systems, the neutral shall be of equivalent ampacity as the phase bus bar. Tapered bus is not acceptable. Full provisions for the addition of future sections shall be provided. Bussing shall include all necessary hardware to accommodate splicing for future additions.
- J. Bus Connections: Shall be bolted with Grade 5 bolts and conical spring washers.
- K. Ground Bus: Sized per NFPA70 and UL 891 Tables 25.1 and 25.2 and shall extend the entire length of the switchboard. Provisions for the addition of future sections shall be provided.
- L. Future Provisions: All unused spaces provided, unless otherwise specified, shall be fully equipped for future devices, including all appropriate connectors and mounting hardware.
- M. Barriers: Between adjacent switchboard sections.
- N. Insulation and isolation for main and vertical buses of feeder sections. Fire pump breakers shall be isolated per NFPA and UL requirements.
- O. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchgear.
- P. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.
- Q. Pull Box on Top of Switchboards:
 - 1. Adequate ventilation to maintain temperature in pull box within same limits as switchgear.
 - 2. Set back from front to clear circuit-breaker removal mechanism.
 - 3. Removable covers shall form top, front, and sides.
 - 4. Bottom shall be insulating, fire-resistive material with separate holes for cable drops into switchgear.
 - 5. Cable supports shall be arranged to facilitate cabling and adequate to support cables indicated, including those for future installation.
- R. Phase-, Neutral- and Ground-Bus Material: Hard-drawn copper of 98 percent conductivity, silver-plated, with copper feeder circuit-breaker line connections.
- S. All bus bars shall extend full length of equipment to permit future additions.

- T. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with mechanical connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.
- U. Isolation Barrier Access Provisions: Permit checking of bus-bolt tightness.
- V. Provide equipment ground fault protection for all 3-phase, 120/208 volt for all overcurrent devices 1200 amps or greater.
- W. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.

2.2 INCOMING MAIN SECTION DEVICES

- A. Two-step stored energy electronic trip molded case circuit breaker(s)
 - 1. Circuit protective devices shall be two-step stored energy type circuit breaker(s).
 - 2. The integral trip system shall be independent of any external power source and shall contain no less than industrial grade electronic components.
 - 3. Circuit breakers shall be equipped with back-up thermal and magnetic trip system.
 - 4. The ampere rating of the circuit breaker shall be determined by the combination of an interchangeable rating plug, the sensor size and the long-time pickup adjustment on the circuit breaker. The sensor size, rating plug and switch adjustments shall be clearly marked on the face of the circuit breaker. Circuit breakers shall be UL Listed to carry 100% of their ampere rating continuously when applied in QED switchboards.
 - 5. The following time/current response adjustments shall be provided. Each adjustment shall have discrete settings and shall be independent from all other adjustments.
 - a. Long Time Pickup & Long Time Delay
 - b. Short Time Pickup & Short Time Delay (I^2t IN & I^2t OUT)
 - c. Instantaneous Pickup
 - d. Ground Fault Pickup & Ground Fault Delay (I^2t IN and I^2t OUT)
 - e. Ground Fault Alarm Only Pickup
 - 6. A means to seal the rating plug and trip unit adjustments in accordance with NEC Section 240-6(b) shall be provided.
 - 7. Local visual trip indication for overload, short circuit and ground fault trip occurrences shall be provided.
 - 8. Long Time Pickup indication to signal when loading approaches or exceeds the adjusted ampere rating of the circuit breaker shall be provided.
 - 9. The trip system shall include a Long Time memory circuit to protect against intermittent overcurrent conditions above the long time pickup point. Means shall be provided to reset Long Time memory circuit during primary injection testing.
 - 10. Circuit breaker trip system shall be equipped with an externally accessible test port for use with a Universal Test Set. Provide one (1) Universal Equipment Test Set for this project job for final inspection. This test set shall be suitable for testing all electric circuit breakers specified for this project. No disassembly of the circuit breaker is required for testing.
 - 11. Circuit breakers shall be provided with Zone Selective Interlocking (ZSI) communications capabilities on the short time and ground fault functions compatible with all other electronic trip circuit breakers and external ground fault sensing systems as noted on schedules and drawings.
 - 12. True two-step stored energy mechanism with five (5) cycle closing time shall be provided. All circuit breakers shall have multiple CHARGE/CLOSE provisions allowing the following sequence:
CHARGE, CLOSE, RECHARGE, OPEN/CLOSE/OPEN
 - 13. Local control pushbuttons to OPEN and CLOSE circuit breaker shall be provided. Color coded visual indication of contact position (OPEN or CLOSED) shall be provided on the face of the circuit breaker. Local manual charging following CLOSE operation shall be provided. Color coded visual indication of mechanism CHARGED and DISCHARGED position shall be provided

- on the face of the circuit breaker. Visual indicator shall indicate CHARGED only when closing springs are completely charged.
14. Each circuit breaker shall be electrically operated to permit remote CHARGE, CLOSE, and OPEN capabilities. Electrically operated circuit breaker shall be equipped with charge contact switch for remote indication of mechanism charge status.
 15. All circuit breakers shall be equipped with electrical accessories as noted on schedules and drawings.
 16. Provide the following interlocking capabilities:
 - a. cell door interlock
 - b. key interlock for main-tie-main
 - c. lock off
 17. Equipment Ground Fault Protection
 - a. Circuit breaker(s) shall be provided with integral equipment protection for grounded systems.
 - b. The ground fault system shall be of the residual type.
 - c. Circuit breaker(s) shall be provided with zone selective interlocking (ZSI) on the Ground Fault function in order to limit thermal stress caused by a fault, yet permit optimum coordination with all other electronic trip circuit breakers.
 18. Terminations
 - a. All lugs shall be UL Listed to accept solid and/or stranded copper conductors only.
 - b. All circuit breakers shall be UL Listed to accept field installable/removable lugs.

2.3 DISTRIBUTION SECTION DEVICES

A. Group mounted circuit breakers through 1200A

1. Circuit breaker(s) shall be group mounted plug-on with mechanical restraint on a common pan or rail assembly.
2. The interior shall have three flat bus bars stacked and aligned vertically with glass reinforced polyester insulators laminated between phases. The molded polyester insulators shall support and provide phase isolation to the entire length of bus.
3. Circuit breaker(s) equipped with line terminal jaws shall not require additional external mounting hardware. Circuit breaker(s) shall be held in mounted position by a self-contained bracket secured to the mounting pan by fasteners. Circuit breaker(s) of different frame sizes shall be capable of being mounted across from each other.
4. Line-side circuit breaker connections are to be jaw type.
5. All unused spaces provided, unless otherwise specified, shall be fully equipped for future devices, including all appropriate connectors and mounting hardware.
6. Electronic trip molded case standard function 80% rated circuit breakers
 - a. All electronic circuit breakers shall have the following time/current response adjustments: Long Time Pickup, Long Time Delay, Short Time Pickup, Short Time Delay, Ground Fault Pickup, Ground Fault Delay and Instantaneous settings. Each adjustment shall have discrete settings (fully adjustable) and shall be independent of all other adjustments.
 - b. Circuit breaker trip system shall be a microprocessor-based true rms sensing designed with sensing accuracy through the thirteenth (13th) harmonic. Sensor ampere ratings shall be as indicated on the associated schedules and drawings.
 - c. Long Time Pickup indication to signal when loading approaches or exceeds the adjustable ampere rating of the circuit breaker shall be provided.
 - d. Furnish thermal magnetic molded case circuit breakers for 250A frames and below.
 - e. All feeder breakers to be ZSI, Zone Selective Interlocking.

B. Individually mounted circuit breakers through 4000A

1. Electronic trip molded/insulated case full function 100% rated circuit breaker(s) through 4000A.

- a. All electronic circuit breakers shall have the following time/current response adjustments: Long Time Pickup, Long Time Delay, Short Time Pickup, Short Time Delay, Ground Fault Pickup, Ground Fault Delay and Instantaneous settings. Each adjustment shall have discrete settings (fully adjustable) and shall be independent of all other adjustments.
- b. Local visual trip indication for overload, short circuit and ground fault trip occurrences.
- c. Long Time Pickup indication to signal when loading approaches or exceeds the adjustable ampere rating of the circuit breaker shall be provided.
- d. Communications capabilities for remote monitoring of circuit breaker trip system, to include phase and ground fault currents, pre-trip alarm indication, switch settings, and trip history information shall be provided.
- e. Circuit breaker shall be provided with Zone selective Interlocking (ZSI) communications capabilities on the short-time and ground fault functions compatible with all other electronic trip circuit breakers and external ground fault sensing systems as noted on schedules and drawings.
- f. All individually mounted feeder breakers above 1200 amps to be fixed mounted.
- g. All feeder breakers to be ZSI, Zone Selective Interlocking.

2.4 SURGE PROTECTION DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 3. Square D; a brand of Schneider Electric.
 4. Siemens
 5. ABB.
- B. Surge Protection Device Description: IEEE C62.41-compliant, integrally mounted, wired-in bolt-on, solid-state, parallel-connected, modular (with field-replaceable modules) type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the switchgear short-circuit rating, and with the following features and accessories:
 1. Integral fused disconnecting means for each surge protection device.
 2. Fabrication using bolted compression lugs for internal wiring.
 3. Integral disconnect shall be able to withstand the single surge rating of the SPD.
 4. Redundant suppression circuits.
 5. Redundant replaceable modules.
 6. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
 7. LED indicator lights for power and protection status.
 8. Audible alarm, with silencing switch, to indicate when protection has failed.
 9. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of system operation. Contacts shall reverse position on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
 10. Six-digit, transient-event counter set to totalize transient surges.
 11. Provide with self-diagnostic test function.
 12. SPD shall be UL labeled as Type 1 or Type 2.
- C. Peak Single-Impulse Surge Current Rating: 240 kA per mode/480 kA per phase.
- D. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.
- E. All units shall be 3-phase, 4-wire and shall have the following surge current capability (single pulse rated): Line to Neutral 480,000 amperes; Line to Ground 480,000 amperes; Line to Line 480,000 amperes; and Neutral to Ground 480,000 amperes. All MOV's shall be individually fused. The unit shall have a NEMA designed and certified safety interlocked integral disconnect switch with an externally mounted manual operator.

- F. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277-V, three-phase, four-wire circuits shall be as follows:
 - 1. Line to Neutral: 800V for 480Y/277.
 - 2. Line to Ground: 800V for 480Y/277.
 - 3. Neutral to Ground: 800V for 480Y/277.
- G. Protection modes and UL 1449 SVR for grounded wye circuits with 208Y/120-V, three-phase, four-wire circuits shall be as follows:
 - 1. Line to Neutral: 400V for 208Y/120.
 - 2. Line to Ground: 400V for 208Y/120.
 - 3. Neutral to Ground: 400V for 208Y/120.

2.5 CONTROL POWER

- A. Control Circuits: 120-V ac, supplied through secondary disconnecting devices from control-power transformer, if required.
- B. Control-Power Fuses: Primary and secondary fuses for current-limiting and overload protection of transformer and fuses for protection of control circuits.
- C. Control Wiring: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for #8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.

2.6 ACCESSORY COMPONENTS AND FEATURES

- A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Portable Test Set: For testing functions of solid-state trip devices without removing from switchgear. Include relay and meter test plugs suitable for testing switchgear meters and switchgear class relays.
- C. Overhead Circuit Breaker Lifting Device: Mounted at top front of switchboard, with hoist and lifting yokes matching each draw-out circuit breaker.
- D. Lock-out, Tag-out: All circuit breakers in the Switchboard to include fixed padlock attachments.

2.7 METERING

- A. Eaton Power Xpert Meter 1000 or acceptable equal manufacturer. Install in face of switchboard.

2.8 IDENTIFICATION

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

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine area to receive switchboard to provide adequate clearance for switchboard installation.
- B. Check that concrete pads are level and free of irregularities.
- C. Start work only after unsatisfactory conditions are corrected.

3.2 EXAMINATION

- A. Receive, inspect, handle, and store switchgears according to NECA 400 and NEMA PB 2.1.
- B. Examine Switchboards before installation. Reject Switchboards that are moisture damaged or physically damaged.

- C. Examine elements and surfaces to receive Switchboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. Install Switchboards and accessories according to manufacturer's written guidelines, NECA 400 and NEMA PB 2.1.
- B. Equipment Mounting: Install Switchboards on concrete base, 4-inch nominal thickness. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."
 - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
 - 2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 4. Install anchor bolts to elevations required for proper attachment to Switchboards.
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from Switchboard units and components.
- D. Operating Instructions: Frame and mount the printed basic operating instructions for Switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of Switchboards.
- E. Install filler plates in unused spaces of panel-mounted sections.
- F. Install overcurrent protective devices, transient voltage suppression devices, and instrumentation.
 - 1. Set field-adjustable switches and circuit-breaker trip ranges.
- G. Comply with NECA 1.

3.4 IDENTIFICATION

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

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. 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.
- C. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each Switchboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.

D. Tests and Inspections:

1. For all breakers with 250A frame and larger 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. Perform the following infrared scan tests and inspections and prepare reports:
 - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each Switchboard.
 - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each Switchboard 11 months after date of Substantial Completion.
 - c. Instruments and Equipment:
 - 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - d. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
4. Inspect completed installation for physical damage, proper alignment, anchorage, and grounding.
5. Measure, using a Megger, the insulation resistance of each bus section phase-to-phase and phaseto-ground for one minute each, at minimum test voltage of 1000 VDC; minimum acceptable value for insulation resistance is 1 megohms. NOTE: Refer to manufacturer's literature for specific testing procedures.
6. Check tightness of accessible bolted bus joints using calibrated torque wrench per manufacturer's recommended torque values.
7. Physically test key interlock systems to check for proper functionality.
8. Test ground fault systems by operating push-to-test button.

E. Switchboard will be considered defective if it does not pass tests and inspections.

3.6 QUALITY CONTROL/STARTUP

- A. Prepare test and inspection reports, including a certified report that identifies Switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.7 ADJUSTING

- A. Tighten bolted bus connections in accordance with manufacturer's instructions.
- B. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- C. Set field-adjustable circuit-breaker trip ranges and time delay settings to recommended values in the Overcurrent Protective Device Coordination Study. Refer to 260573, "Electrical Studies".

3.8 CLEANING

- A. On completion of installation, inspect interior and exterior of switchboards. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair damaged finishes.
- B. Touch-up scratched or marred surfaces to match original finish.

3.9 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain Switchboards, overcurrent protective devices, instrumentation, and accessories, and to use and reprogram microprocessor-based trip, monitoring, and communication units.

- B. Training of the owner's operation and maintenance personnel is required in cooperation with the Commissioning Authority. The instruction shall be scheduled in coordination with the Commissioning Authority after submission and approval of formal training plans. Refer to Section 019113 and the Commissioning Plan for further contractor training requirements.

END OF SECTION

DIVISION 26 – ELECTRICAL

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The Contractor is directed to examine each and every section of these specifications, all drawings relating to the Contract Documents, any and all Addenda, etc., for work described elsewhere that may relate to the provision of the work described herein. Materials and performance requirements are specified elsewhere herein that relate to these systems.
- C. Each Electrical Contractor's attention is directed to Section 260501 - General Provisions, Electrical, and all other Contract Documents as they apply to his work.

1.2 SUMMARY

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

1.3 DESCRIPTION OF WORK

- A. All panelboards shall be of the circuit breaker type, and shall be of one manufacturer.
- B. Branch panelboards shall be as indicated on the drawings and as specified herein. The lighting panelboards shall be of the dead-front, quick-make, quick-break, bolt-on circuit breaker type, with trip indicating and trip free handles. All circuits shall be clearly and properly numbered and shall be provided with thermal magnetic protection.
- C. The panelboards shall be enclosed in code gauge, galvanized steel cabinets with smooth finished hinged doors without visible external fasteners and heavy chrome locks. Provide baked-on grey enamel finish, in accord with ANSI 61. Panels shall be constructed in accord with Federal Specification W-P-115B Type 1 Class 1, UL67, UL50, NEMA P31, and NFPA 70. Locks shall all be keyed alike.
- D. Each door shall have a directory card inside, covered with a plastic shield, with typewritten circuit numbers and description indicated. Room numbers shall be coordinated with final room numbers as selected by Owner, not numbers on Contract Documents.
- E. Panelboard trim for surface or flush panels shall be double-hinged type, to allow exposure of dead-front breaker portion behind locked door, with screw-fastened gutter trim that is hinged to allow full access to wiring gutters.
- F. Special Note: The room numbers used to fill out the panel directories shall match the actual final name and numbering scheme selected by the Owner. They shall not be filled out per the construction drawing numbering scheme, unless the Contractor is directed to do so by the Architect or Engineer.
- G. Branch panelboards shall be surface or flush mounted as indicated on the Contract Drawings. Flush panels trims shall be tight to wall and interior barriers, with no gaps allowing access to live parts. Oversize trims will not be acceptable.
- H. Note: Where mounted in groups, align top of trim or tub for all panels in an area. Exact mounting height of topline shall be as directed by the Engineer.
- I. All main bus and connections thereto in panelboards shall be copper. All bus bars shall extend full length of panelboards.

J. All panelboards shall have full size un-insulated copper ground busses and insulated full neutral busses.

K. All panelboards shall be provided with an SPD per Specification 264313, Surge Protection for Low-Voltage Electrical Power Circuits.

1.4 DEFINITIONS

A. SVR: Suppressed voltage rating.

B. GFCI: Ground-fault circuit interrupter

1.5 ACTION SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, surge suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Include evidence of NRTL listing for series rating of installed devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal, and control wiring.
8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.6 INFORMATIONAL SUBMITTALS

A. Panelboard Schedules: For installation in panelboards. Submit final version after load balancing.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "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.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each panelboard cabinet lock. All keys shall match.

1.9 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

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 space available for panelboards including clearances between panelboards and adjacent surfaces and other items. Furnish and install equipment to comply with NEC clearances.
 - 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.
- 1.10 DELIVERY, STORAGE, AND HANDLING
- A. Handle and prepare panelboards for installation according to NECA 407 and NEMA PB 1.
- 1.11 PROJECT CONDITIONS
- A. Environmental Limitations: Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
 - 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 Construction Manager no fewer than 14 days in advance of proposed interruption of electric service.
 - 2. Do not proceed with interruption of electric service without Construction Manager's written permission.
 - 3. Comply with NFPA 70E.
- 1.12 COORDINATION
- 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. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
- 1.13 WARRANTY
- A. The equipment items shall be supported by service organizations which are reasonably convenient (less than 100 miles from project site) to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.
 - B. All panelboards, finishes, and all of its component parts, and controls shall have an unconditional one (1) year warranty. Warranty shall include finishes and all components to be free from defects in materials and workmanship for a period of one (1) year from date of Owner's acceptance. Replacement of panelboards, faulty materials and the cost of labor to make the replacement shall be the responsibility of the Contractor.
 - C. The Warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under provisions of the Contract Documents and shall be in addition to, and run concurrently with other warranties made by the Contractor under requirements of the Contract Documents.
 - D. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace surge suppression devices that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.
 - E. Comply with the requirements of Section 019113 for the commissioning of the various building systems.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. All panelboards shall be of the circuit breaker type, and shall be of one manufacturer.
- B. Enclosures: Flush- and surface-mounted cabinets. Box width shall not exceed 20" wide. Rated for environmental conditions at installed location.
 - 1. Indoor Dry and Clean Locations: NEMA 250, Type 1.
- C. Type 1 Boxes
 - 1. Boxes shall be hot zinc dipped galvanized steel constructed in accordance with UL 50 requirements. Unpainted galvanized steel is not acceptable.
 - 2. Boxes shall have removable end walls. End walls shall not be provided with concentric knockouts. Boxes shall have welded interior mounting studs. Interior mounting brackets are not required.
 - 3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
 - 4. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
 - 5. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
 - 6. Finishes: Panels, Back Boxes and Trim: Galvanized Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
 - 7. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.
 - 8. All lock assemblies shall be keyed alike.
- D. Incoming Mains Location: Top and bottom to match feeder conduit entry. Feeders routed through the side gutters to reach the top or bottom main breakers from the opposite end of the panel are not acceptable.
- E. Phase, Neutral, and Ground Busses:
 - 1. Material: Fully plated, hard-drawn copper, 98 percent conductivity.
 - 2. Equipment Ground Bus: Extend full length of panelboard and adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
 - 3. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box. Provide where shown on drawings.
 - 4. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads. Provide when supplied by K rated transformers.
 - 5. Split Bus: Vertical buses divided into individual vertical sections.
- F. Conductor Connectors: Suitable for use with conductor material and sizes.
 - 1. Main and Neutral Lugs: Mechanical type.
 - 2. Ground Lugs and Bus-Configured Terminators: Mechanical type.
 - 3. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 - 4. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
 - 5. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.
- G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- H. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 DISTRIBUTION PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Square D; a brand of Schneider Electric.
 - 2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 4. Siemens.
 - 5. ABB.
- B. Panelboards: NEMA PB 1, power and feeder distribution type.
- C. Doors: Secured with vault-type latch with tumbler lock; keyed alike. For doors more than 36 inches high, provide two latches, keyed alike.
- D. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
- E. Branch Overcurrent Protective Devices 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.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Square D; a brand of Schneider Electric.
 - 2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 4. Siemens.
 - 5. ABB.
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- D. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.
- E. Interior:
 - 1. Continuous main current ratings, as indicated on associated drawings.
 - 2. Short circuit rating as shown on the schedules.
 - 3. Provide one (1) continuous bus bar per phase. Each bus bar shall have sequentially phased branch circuit connectors limited to bolt-on branch circuit breakers. The bussing shall be fully rated. Panelboard bus current ratings shall be determined by heat-rise tests conducted in accordance with UL 67. Bussing shall be plated copper. Bus bar plating shall run the entire length of the bus bar. Panelboards shall be suitable for use as Service Equipment when application requirements comply with UL 67 and NEC Articles 230-F and -G.
 - 4. All current-carrying parts shall be insulated from ground and phase-to-phase by high dielectric strength thermoplastic.
 - 5. A solidly bonded copper equipment ground bar shall be provided.
 - 6. Split solid neutral shall be plated and located in the mains compartment up to 250 amperes so all incoming neutral cable may be of the same length.
 - 7. Interior trim shall be of dead-front construction to shield user from energized parts. Dead-front trim shall have filler plates covering unused mounting space.
 - 8. Nameplates shall contain system information and catalog number or factory order number. Interior wiring diagram, neutral wiring diagram, CSA/UL Listed label and short circuit current rating shall be displayed on the interior or in a booklet format.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Square D; a brand of Schneider Electric.
 - 2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
- B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
 - 1. Circuit breakers shall be CSA and UL Listed with amperage ratings, interrupting ratings, and number of poles as indicated on the panelboard schedules.
 - 2. Molded case branch circuit breakers shall have bolt-on type bus connectors.
 - 3. Circuit breakers shall have an overcenter toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have thermal and magnetic trip elements in each pole. Two- and three-pole circuit breakers shall have common tripping of all poles.
 - 4. There shall be two forms of visible trip indication. The circuit breaker handle shall reside in a position between ON and OFF. In addition, there shall be a red indicator appearing in the clear window of the circuit breaker housing.
 - 5. The exposed faceplates of all branch circuit breakers shall be flush with one another.
 - 6. Lugs shall be UL Listed to accept solid or stranded copper and aluminum conductors.
 - 7. 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.
 - 8. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 - 9. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replaceable electronic trip; and the following field-adjustable settings:
 - 10. Instantaneous trip.
 - 11. Long- and short-time pickup levels.
 - 12. Long- and short-time time adjustments.
 - 13. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 - 14. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
 - 15. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
 - 16. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
 - 17. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - c. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - d. Shunt Trip: 120 V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
 - e. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.

2.5 ACCESSORY COMPONENTS AND FEATURES

- A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Receive, inspect, handle, and store panelboards according to NECA 407.
- B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install panelboards and accessories according to NECA 407 and NEMA PB 1.1.
- B. Equipment Mounting: Install floor-mounted panels on concrete bases, 4-inch nominal thickness. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."
 - 1. 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.
 - 2. For panelboards, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 4. Install anchor bolts to elevations required for proper attachment to panelboards.
 - 5. Attach panelboard to the vertical finished or structural surface behind the panelboard.
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
- D. Comply with mounting and anchoring requirements specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."
- E. Mount top of trim 90 inches above finished floor unless otherwise indicated.
- F. 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.
- G. Install overcurrent protective devices and controllers not already factory installed. Set field-adjustable, circuit-breaker trip ranges.
- H. Install filler plates in unused spaces.
- I. Stub four (4) 1-inch and two (2) 1-1/4"-inch empty conduits from recessed panelboard into accessible ceiling space or space designated to be ceiling space in the future.
- J. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.
- K. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Each door shall have a directory card inside, covered with a plastic non-yellowing shield. Directory Card to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer to create directory in Microsoft Excel; handwritten directories are not acceptable. Digital versions to be provided to Owner.
- B. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553.

- C. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 260553.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. 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.
- 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.

3.5 CLEANING

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

3.6 ADJUSTING

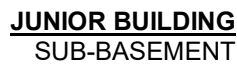
- A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573.
- C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
 - 1. Measure as directed during period of normal system loading.
 - 2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
 - 3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
 - 4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

END OF SECTION

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- A. REFER TO SPECIFICATIONS FOR CONDUCTOR REQUIREMENTS. ALL FEEDERS SHALL BE IDENTIFIED BY A COLOR CODE.
- B. PROVIDE ENGRAVED LAMACOD LABELS FOR ALL POWER DISTRIBUTION EQUIPMENT FURNISHED OR MODIFIED IN THIS PROJECT. LABELS PER DETAILS AND SPECIFICATIONS.
- C. SERVICE EQUIPMENT SHALL BE MARKED WITH THE MAXIMUM AVAILABLE FAULT-CURRENT AT THE EQUIPMENT AND THE DATE THE CALCULATION WAS PERFORMED. APPLY A TAPE OR LABEL WITH A REFLECTIVE LABEL WITH WHITE BACKGROUND, 1/2" HIGH BLACK LETTERING.
- D. CONTRACTOR SHALL INSTALL SEPARATE CONDUCTORS, PULL BOXES, ETC. FOR EACH EMERGENCY POWER BRANCH & NORMAL POWER PER NEC FOR COMPLETE SEPARATION OF POWER SERVICES.
- E. ALL CIRCUIT BREAKERS AND/OR DISCONNECTS SERVING THE PRIMARY SIDE OF A TRANSFORMER SHALL BE IDENTIFIED WITHIN THE SITE OF THE TRANSFORMER SHALL BE PROVIDED WITH PERMANENTLY INSTALLED MEANS TO LOCK THE BREAKER IN THE OFF POSITION. SUCH TRANSFORMERS SHALL HAVE THE ROOM NAME AND NUMBER OF THE PRIMARY DISCONNECTING MEANS ENGRAVED ON THE EQUIPMENT NAMEPLATE.
- F. ALL SPARE BREAKERS SHALL BE SO LABELED IN CIRCUIT DIRECTORIES AND SHALL BE LEFT IN THE OFF POSITION.
- G. MINIMUM PANEL MOUNTING SPACE IS NOTED ON DRAWINGS AND SCHEDULES. ALL MOUNTING SPACE SHALL BE PREPARED TO ACCEPT FUTURE BREAKERS.
- H. NO CONDUIT SHALL BE INSTALLED UNDERGROUND, EXCEPT FOR DISTRIBUTION EQUIPMENT FEEDERS, EXTERIOR CONDUITS, PARKING LOT ISLANDS, UNLESS REQUIRED FOR THE APPLICATION (PULL BOXES, ISLANDS, ETC.) OR SPECIFICALLY INDICATED AS SUCH IN CONSTRUCTION DOCUMENTS. NO CONDUIT SHALL BE INSTALLED WITHIN CONCRETE SLABS.
- I. SEE SPECIFICATIONS FOR POWER STUDY REQUIREMENTS.
- J. PROVIDE ELECTRONIC TRIP BREAKERS ON ALL EMERGENCY BRANCH CIRCUITS WHERE REQUIRED FOR SELECTIVE COORDINATION.
- K. ALL ELECTRICAL EQUIPMENT SHALL BE IDENTIFIED BY EQUIPMENT DISCONNECT WHERE REQUIRED FOR ALL MECHANICAL EQUIPMENT. COORDINATE CONNECTION AND LOCATION WITH MECHANICAL CONTRACTOR AND SUBMITTALS PRIOR TO RUNNING CONDUIT AND WIRE.

KEYNOTES - AD-E006	
E1	EXTEND EXISTING BRANCH CIRCUIT TO NEW EQUIPMENT LOCATION. MATCH EXISTING CONDUCTOR SIZE AND PROVIDE ACCORDINGLY.
E2	PROVIDE NEW EATON POW-R-LINE EXPERT GENERAL PURPOSE DISTRIBUTION SWITCHBOARD OR ACCEPTABLE EQUAL. PROVIDE WITH HORIZONTAL BUS EXTENSION FOR FUTURE ADDITIONAL DISTRIBUTION SECTION.



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- B. SHALL BE COPPER UNLESS OTHERWISE NOTED.
- C. PROVIDE ENGRAVED LAMACOID LABELS FOR ALL POWER DISTRIBUTION EQUIPMENT FURNISHED OR MODIFIED IN THIS PROJECT. LABELS PER DETAILS AND SPECIFICATION.
- D. SERVICE EQUIPMENT SHALL BE MARKED WITH THE MAXIMUM AVAILABLE FAULT-CURRENT AT THE EQUIPMENT AND THE DATE THE CALCULATION WAS PERFORMED. APPLY A TYPE-WRITTEN ADHESIVE LABEL WITH WHITE INK ON THE FRONT, 12" HIGH BLACK LETTERING.
- E. CONTRACTOR SHALL INSTALL SEPARATE CONDUITS, PULL BOXES, ETC. FOR EACH EMERGENCY POWER BRANCH & NORMAL POWER PER NEC FOR COMPLETE SEPARATION OF POWER SERVICES.
- F. ALL CIRCUIT BREAKERS AND/OR DISCONNECTS SERVING THE PRIMARY SIDE OF A TRANSFORMER SHALL BE INSTALLED ON THIS SITE OR THE TRANSFORMER SHALL BE PROVIDED WITH PERMANENTLY INSTALLED MEANS TO LOCK THE BREAKER IN THE OFF POSITION. SUCH TRANSFORMERS SHALL HAVE THE ROOM NAME AND NUMBER OF THE PRIMARY DISCONNECTING MEANS ENGRAVED ON THE EQUIPMENT NAMEPLATE.
- G. ALL SPARE BREAKERS SHALL BE SO LABELED IN CIRCUIT DIRECTORIES AND SHALL BE LEFT IN THE OFF POSITION.
- H. MINIMUM PANEL MOUNTING SPACE IS NOTED ON DRAWINGS AND SCHEDULES. ALL MOUNTING SPACE SHALL BE PREPARED TO ACCEPT FUTURE BREAKERS.
- I. ALL SHEDS TO BE INSTALLED WITH 120V, 20 AMP, GROUNDING AND DISTRIBUTION EQUIPMENT FEEDERS, EXTERIOR CONDUITS, PARKING LOT ISLANDS, UNLESS REQUIRED FOR THE APPLICATION (FLOOR BOXES, ISLANDS, ETC.) OR SPECIFICALLY INDICATED AS SUCH IN CONSTRUCTION DOCUMENTS. NO CONDUIT SHALL BE INSTALLED WITHIN CONCRETE SLABS.
- J. ALL SPECIFICATIONS FOR ELECTRICAL AND EMERGENCY SERVICES SHALL BE PROVIDED.
- K. PROVIDE ELECTRONIC TRIP BREAKERS ON ALL EMERGENCY BRANCH CIRCUITS WHERE REQUIRED FOR SELECTIVE COORDINATION.
- L. TRANSITION ALUMINUM (AL) TO COPPER (CU) AT EQUIPMENT CONNECTIONS WHERE AL AND CU ARE USED. PROVIDE APPROPRIATE CONNECTION AND LOCATION WITH MECHANICAL CONTRACTOR AND SUBMITTALS PRIOR TO RUNNING CONDUIT AND WIRE.

KEYNOTES - AD-E007	
E1	EXTEND EXISTING BRANCH CIRCUIT TO NEW EQUIPMENT LOCATION. MATCH EXISTING CONDUCTOR SIZE AND PROVIDE ACCORDINGLY.
E2	PROVIDE NEW EATON POW-R-LINE XPRT GENERAL PURPOSE DISTRIBUTION SWITCHBOARD OR ACCEPTABLE EQUAL.
E3	PROVIDE NEW EATON POW-R-LINE 4B DISTRIBUTION PANELBOARD OR ACCEPTABLE EQUAL.
E4	PROVIDE NEW FUSIBLE DISCONNECT.

