January 30, 2025

ADDENDUM #3

TO CONTRACT DOCUMENTS FOR:	Project #CP231541 – Virginia Avenue Substation and Underground Ductbank
ADVERTISEMENT DATE:	November 21, 2024
PREPARED FOR:	The Curators of the University of Missouri
CONSULTANT:	Jacobs Engineering Group, Inc. 777 Main Street, 23rd Floor Fort Worth, Texas 76102

The contract documents for the above noted project and the work covered thereby and herein modified.

GENERAL INFORMATION:

1) Drawings for the existing substation to be demolished are included in this Addendum 3 for information only. They are not incorporated into the Project Drawings.

PROJECT MANUAL(VOLUME 1):

1) Replace existing TABLE OF CONTENTS with attached updated TABLE OF CONTENTS
2) Document 1.A "BID FOR LUMP SUM CONTRACT". The revised Bid For Lump Sum Contract is attached. Changes to this section include:
    a. Section 3c(7) – Change units from cubic yards to linear feet
    b. Section 3c(8) – Change units from cubic yards to linear feet
    c. Section 4a – Change Project duration to 850 calendar days
    d. Section 4c "Special Scheduling Requirements" – Add LONG LEAD EQUIPMENT DELIVERIES provision

    BIDS MUST BE SUBMITTED ON THE ATTACHED REVISED FORM.
3) Replace page Page SC-5 with the attached revised Page SC-5. Changes to this page include updating the list of Delegated Design Items.
4) Insert Section 071353 – ELASTOMERIC SHEET WATERPROOFING
5) Insert Section 087100 – DOOR HARDWARE

PROJECT MANUAL (VOLUME 2):

1) Replace existing TABLE OF CONTENTS with attached updated TABLE OF CONTENTS
2) Replace Section 261326 – MEDIUM VOLTAGE METAL CLAD SWITCHGEAR

DRAWINGS:

1) General: Replace the following Rev A drawing with the attached Rev B drawing:
   G-102
2) Civil: Replace following Rev A drawings with attached Rev B drawings:
   C-804 C-805
3) Architectural: Replace following Rev A drawing with attached Rev B drawing:
   A-461
4) Electrical: Replace Follow Rev A drawings with attached Rev B drawings:
   E-062 E-063 E-071 E-604 E-609
5) Mechanical: Replace the following Rev B drawings with attached Rev C drawings:
   MH-101 MH-103 MH-104
6) Existing Substation to be demolished: drawings attached for information

PROJECT MANUAL FOR: GENERAL SITE – VIRIGINIA AVENUE SUBSTATION AND UNDERGROUND DUCTBANK

PROJECT NUMBER: CP231541

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VOLUME 1

DIVISION 9	FINISHES
092900	GYPSUM BOARD
096513	RESILIENT BASE AND ACCESSORIES
099113	EXTERIOR PAINTING
099123	INTERIOR PAINTING
DIVISION 10	SPECIALTIES
102800	TOILET, BATH AND LAUNDRY ACCESSORIES
DIVISION 11	NOT USED
DIVISION 12	NOT USED
DIVISION 13	NOT USED
DIVISION 14	NOT USED
DIVISION 21	NOT USED

PROJECT MANUAL FOR: GENERAL SITE – VIRIGINIA AVENUE SUBSTATION AND UNDERGROUND DUCTBANK

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VOLUME 2

SECTION 1.A

BID FOR LUMP SUM CONTRACT
ADDENDUM 3

Date: _____

BID OF _____
(hereinafter called "Bidder") a corporation * organized and existing under laws of the State of _____,
A partnership * consisting of _____,
An individual* trading as _____,
A joint venture* consisting of _____
_____.
*Insert Corporations(s), partnership or individual, as applicable.

TO: Curators of the University of Missouri
c/o Associate Vice Chancellor – Facilities
Room L100, General Services Building
University of Missouri – Columbia
Columbia, MO 65211

1. Bidder, in compliance with invitation for bids for construction work in accordance with Drawings and Specifications prepared by JACOBS ENGINEERING GROUP, INC., entitled "GENERAL SITE – VIRGINIA AVENUE SUBSTATION AND UNDERGROUND DUCTBANK" project number CP231541, dated NOVEMBER 13, 2024 having examined Contract Documents and site of proposed work, and being familiar with all conditions pertaining to construction of proposed project, including availability of materials and labor, hereby proposed to furnish all labor, materials and supplies to construct project in accordance with Contract Documents, within time set forth herein at prices stated below. Prices shall cover all expenses, including taxes not covered by the University of Missouri's tax exemption status, incurred in performing work required under Contract documents, of which this Bid is a part.

   Bidder acknowledges receipt of the following addenda:

   Addendum No. _____ Dated _____
   Addendum No. _____ Dated _____
   Addendum No. _____ Dated _____
   Addendum No. _____ Dated _____

2. In the following Bid(s), amount (s) shall be written in both words and figures. In case of discrepancy between words and figures, words shall govern.

3. BID PRICING

required to construct new substation building and equipment yard, new underground ductbank and fiber network; to include all sitework, utilities, structural, architectural, electrical, demolition, and equipment furnishing and installation (except as otherwise noted) as indicated on the Drawings and described in these Specifications for a sum of: _____ _____DOLLARS ($ _____).

b. Additive Alternate Bids:

No Bid Alternates have been identified for this solicitation.

c. Unit Prices:

(1) For changing specified quantities of work from those indicated by Contract Drawings and Specifications, upon written instruction of the Owner's Representative, the following Unit Prices shall prevail in accordance with the General Conditions.

(2) The following Unit Prices include all labor, overhead and profit, materials, equipment, appliance, bailing, shoring, shoring removal, etc., to cover all work.

(3) The following Unit Prices are required where applicable to particular Base Bid and/or Alternate being submitted.

(4) Only a single Unit Price shall be given, and it shall apply for either MORE or LESS work than that indicated on Drawings and called for in Specifications as indicated to be included in Base Bid and/or Alternates. In the event that more or less units than so indicated is actually furnished, Change Orders will be issued for increased or decreased amounts as approved by the Owner's Representative.

(5) Bidder understands that the Owner will not be liable for any Unit Price or any amount in excess of Base Bid and any Alternate(s) accepted at time of award of Contract, except as expressed in written Change Orders duly executed and delivered by the Owner's Representative.

(6) Rock Excavation in addition to soil excavation, as defined in Division 2, per cu. yd.

(a) General Excavation,
Base Bid quantity = 1200 cu. yd. $_____/cu. yd.

(b) Trench Excavation
Base Bid quantity = 500 cu. yd. $_____ / cu. yd.

(7) Drilled Pier Soil Excavation / l.f per Spec 316329,

(a) Up to 18" dia,
Base Bid quantity = 400 l.f. $_____/cu. yd.

(b) 36" dia,
Base Bid quantity = 200 l.f. $_____ / cu. yd.

(c) 42" dia,
Base Bid quantity = 50 l.f. $_____ / cu. yd.

(8) Drilled Pier Rock Excavation / l.f

(a) Up to 18" dia,
Base Bid quantity = 150 l.f. $_____/cu. yd.

(b) 36" dia,
Base Bid quantity = 200 l.f. $_____ / cu. yd.

(c) 42" dia,
Base Bid quantity = 50 l.f. $_____ / cu. yd.

4. PROJECT COMPLETION

a. Contract Period – Contract period begins on the day the Contractor receives unsigned Contract, Performance Bond, Payment Bond, and "Instructions for Execution of Contract, Bonds, and Insurance Certificates." Bidder agrees to complete project within 850 calendar days from receipt of aforementioned documents. Fifteen (15) calendar days have been allocated in construction schedule for receiving aforementioned document from Bidder.

b. Commencement – Contractor agrees to commence work on this project after the "Notice to Proceed" is issued by the Owner. "Notice to Proceed" will be issued within seven (7) calendar days after the Owner receives properly prepared and executed Contract documents listed in paragraph 4.a. above.

c. Special Scheduling Requirements –

LONG LEAD EQUIPMENT DELIVERIES: Estimated delivery for 69kV circuit breakers is early 2027. This extended lead time is factored into the overall contract period. Contractor agrees to account for this anticipated delivery time, and agrees to waive claims for extended overhead, remobilization, and other costs related to the delivery of the 69kV breakers.

SCHEDULED POWER OUTAGES: Contractor agrees to submit for approval a schedule of all major and minor power outages necessary to complete the work. Transmission line outages will be limited to the calendar windows and durations indicated on the drawings and require 30 days prior approval by both the University and the designated Utility Provider. Outages to facilitate transfer of existing on-campus circuits to new substation will be limited

to the calendar windows and durations indicated on the drawings and will require 14 days prior approval by the University.

SCHEDULED FIBER INTERRUPTIONS: Contractor agrees to submit for approval a schedule of all fiber communications interruptions necessary to complete the work. Outages to facilitate transfer of existing on-campus fiber runs to new substation will be limited to the calendar windows and durations indicated on the drawings and will require 14 days prior approval by the University.

ROAD CLOSURES: Contractor agrees to submit for approval a schedule for all temporary road closures necessary to compete the work. Contractor to limit road closures to calendar windows and durations as dictated by the University in order to minimize impact to campus operations.

5. SUBCONTRACTOR LIST:

Bidder hereby certifies that the following subcontractors will be used in performance of Work:

NOTE: Failure to list subcontractors for each category of work identified on this form or listing more than one subcontractor for any category of work without designating the portion of work performed by each shall be grounds for rejection of bid. List name, city, and state of designated subcontractor, for each category of work listed in Bid For Lump Sum Contract. If work within a category will be performed by more than one subcontractor, Bidder shall provide name, city, and state of each subcontractor and specify exact portion of work to be performed by each. If acceptance/non-acceptance of Alternates will affect designation of a subcontractor, Bidder shall provide information, for each affected category, with this bid form. If Bidder intends to perform any designated subcontract work by using Bidder's own employees, then Bidder shall list their own name, city, and state. The bidder may petition the Owner to change a listed subcontractor only within 48 hours of the bid opening. See Information For Bidders Section 16 List of Subcontractors for requirements.

Work to be performed	Subcontractor Name, City, and State
Civil	
Building/Architectural	
Electrical (MV)	
Ductbank/Utility	

Structural Concrete _____

Roofing Systems _____

Fiber Distribution _____

6. SUPPLIER DIVERSITY PARTICIPATION GOALS

a. The Contractor shall have as a goal, subcontracting with Minority Business Enterprise (MBE) of ten percent (10%), with Women Business Enterprise (WBE), Disadvantage Business Enterprise (DBE), and/or Veteran Owned Business Enterprise, of three percent (3%), with Service-Disable Veteran Owned Business (SDVE) of three percent (3%) of awarded contract price for work to be performed.

b. Request for waiver of this goal shall be submitted on the attached Application For Waivers form. A determination by the Director of Facilities Planning & Development, UM, that a good faith effort has not been made by Contractor to achieve above stated goal may result in rejection of bid.

c. The Undersigned proposed to perform work with following Supplier Diversity participation level:

MBE PERCENTAGE PARTICIPATION:
_____ percent (_____%)

WBE, DBE, and/or VETERAN PERCENTAGE PARTICIPATION
_____ percent (_____%)

SDVE PERCENTAGE PARTICIPATION:
_____ percent (_____%)

d. A Supplier Diversity Compliance Evaluation form shall be submitted with this bid for each diverse subcontractor to be used on this project.

7. BIDDER'S ACKNOWLEDGEMENTS

a. Bidder declares that he has had an opportunity to examine the site of the work and he has examined Contract Documents therefore; that he has carefully prepared his bid upon the basis thereof; that he has carefully examined and checked bid, materials, equipment and labor required thereunder, cost thereof, and his figures therefore. Bidder hereby states that amount, or amounts, set forth in bid is, or are, correct and that no mistake or error has occurred in bid or in Bidder's computations upon which this bid is based. Bidder agrees that he will make no claim for reformation, modifications, revisions or correction of bid after scheduled closing time for receipt of bids.

b. Bidder agrees that bid shall not be withdrawn for a period of ninety (90) days after scheduled closing time for receipt of bids.

c. Bidder understands that Owner reserves right to reject any or all bids and to waive any informalities in bidding.

d. Accompanying the bid is a bid bond, or a certified check, or a cashier's check payable without condition to "The Curators of the University of Missouri" which is an amount at least equal to five percent (5%) of amount of largest possible total bid herein submitted, including consideration of Alternates.

e. Accompanying the bid is a Bidder's Statement of Qualifications. Failure of Bidder to submit the Bidder's Statement of Qualifications with the bid may cause the bid to be rejected. Owner does not maintain Bidder's Statements of Qualifications on file.

f. It is understood and agreed that bid security of two (2) lowest and responsive Bidders will be retained until Contract has been executed and an acceptable Performance Bond and Payment Bond has been furnished. It is understood and agreed that if the bid is accepted and the undersigned fails to execute the Contract and furnish acceptable Performance/Payment Bond as required by Contract Documents, accompanying bid security will be realized upon or retained by Owner. Otherwise, the bid security will be returned to the undersigned.

8. BIDDER'S CERTIFICATE

Bidder hereby certifies:

a. His bid is genuine and is not made in interest of or on behalf of any undisclosed person, firm or corporation, and is not submitted in conformity with any agreement or rules or any group, association or corporation.

b. He has not directly or indirectly induced or solicited any other bidder to put in a false or sham bid.

c. He has not solicited or induced any person, firm or corporation to refrain from bidding.

d. He has not sought by collusion or otherwise to obtain for himself any advantage over any other Bidder or over Owner.

e. He will not discriminate against any employee or applicant for employment because of race, color, religion, sex or national origin in connection with performance of work.

f. By virtue of policy of the Board of Curators, and by virtue of statutory authority, a

preference will be given to materials, products, supplies, provisions and all other articles produced, manufactured, mined or grown within the State of Missouri. By virtue of policy of the Board of Curators, preference will also be given to all Missouri firms, corporations, or individuals, all as more fully set forth in "Information For Bidders."

END OF BIDDER'S CERTIFICATE

9. BIDDER'S SIGNATURE

Note: All signatures shall be original; not copies, photocopies, stamped, etc.

Authorized Signature	Date
Printed Name	Title
Company Name	
Mailing Address	
City, State, Zip	
Phone No.	Federal Employer ID No.
Fax No.	E-Mail Address
Circle one: Individual Partnership Corporation Joint Venture	
If a corporation, incorporated under the laws of the State of_____	
Licensed to do business in the State of Missouri? ____yes _____no	

(Each Bidder shall complete bid form by manually signing on the proper signature line above and supplying required information called for in connection with the signature. Information is necessary for proper preparation of the Contract, Performance Bond and Payment Bond. Each Bidder shall supply information called for in accompanying "Bidder's Statement of Qualifications.")

END OF SECTION

structural steel for electrical equipment.

(5) Mechanical work shall consist of plumbing, HVAC, and fire protection for Virginia Avenue Substation building as indicated.

(6) Electrical work shall consist of procurement and installation of all electrical equipment (except as noted below). Provide and install all cable tray, conduit, cable trench, ductbank, wiring, and building wiring as indicated on the drawings and as necessary to energize the Virginia Avenue substation.

(7) Delegated Design Items:

Contractor shall be responsible for completing the design of the following items. Delegated design shall be performed by or under the direction of an Architect/Engineer registered in the state of Missouri. Architect/Engineer's seal shall be affixed to all delegated design submittals.

ITEM NO	DESCRIPTION	COMMENTS
1.0	Equipment Anchorage	Major equipment will be precured by the construction contractor, so equipment anchoring requirements will not be known until after IFC drawings are issued.
2.0	Precast Concrete Building Panels	This is a specialty fabrication item where design by the fabricator is appropriate
3.0	Hangers and Support Systems	Delegation of design for support systems for suspended piping, cable tray, and ductwork is standard.
4.0	Electrical System Support tructures	This is a specialty fabrication item where design by the fabricator is appropriate. Fabricators are able to incorporate cylindrical and eliptical sections which are more economical than designing with standard strcutural members.
5.0	OH to Underground Tangent Pole	This is a specialty fabrication item where design by the fabricator is appropriate.
6.0	Lightning Protection of Substation Building	It is appropriate to delegate this design to a UL-certified installer in order to satisfy UL Lightning Protection requirements
7.0	Fire Protection for OT Room in Substation Bldg.	This is a specialty self-contained fire control system designated for small areas where delegation of design to the specialty fabricator is appropriate.
8.0	Operable Slide Gates	This is a specialty fabrication item where design by the fabricator is appropriate.
9.0	Protective Relay Settings	By Contractor
10.0	Building Fire Detection (Alarms, Beacons, and Emergency Egress Lighting)	Design Provide and Install per NFPA 72 and University Guidelines. Install and connect Owner-provided Fire Control Panel

4. LOCATION

a. Work shall be performed under this Contract on the campus of the University of Missouri - Columbia, at the locations indicated on the drawings.

Virginia Avenue Substation Address: 1020 Virginia Avenue, Columbia MO 65211

5. NUMBER OF CONSTRUCTION DOCUMENTS

a. The Owner's Representative will furnish the Contractor a copy of the executed Contract and a complete set of Drawings and Specifications in PDF format.

SECTION 071353 - ELASTOMERIC SHEET WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sheet waterproofing.
2. Plaza-deck pavers.

B. Related Requirements:

1. Section 071354 "Thermoplastic Sheet Waterproofing" for PVC sheet waterproofing.
2. Section 079513.16 "Exterior Expansion Joint Cover Assemblies" for exterior-wall expansion-joint assemblies that interface with waterproofing.
3. Section 079513.19 "Parking Deck Expansion Joint Cover Assemblies" for deck expansion-joint assemblies that interface with waterproofing.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.

B. Shop Drawings: Show locations and extent of waterproofing and details of substrate joints and cracks, expansion joints, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

1. Include setting drawings showing layout, sizes, sections, profiles, and joint details of pedestal-supported concrete pavers.

C. Samples: For each exposed product and for each color and texture specified, including the following products:

1. 8-by-8-inch (200-by-200-mm) square of waterproofing and flashing sheet.
2. 4-by-4-inch (100-by-100-mm) square of drainage panel.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Field quality-control reports.

C. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.

B. Mockups: Build mockups to verify selections made under Sample submittals and to set quality standards for installation.

1. Build for each typical waterproofing installation including accessories to demonstrate surface preparation, crack and joint treatments, inside and outside corner treatments, and protection.

    a. Size: 100 sq. ft. (9.3 sq. m) in area.
    b. Description: Each type of wall installation.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.

1. Do not apply waterproofing in snow, rain, fog, or mist.

B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.

B. Installer's Special Warranty: Specified form, by Installer, covering Work of this Section, for warranty period of two years.

1. Warranty includes removing and reinstalling protection board, drainage panels, insulation, pedestals, and pavers on plaza decks.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Source Limitations for Waterproofing System: Obtain waterproofing materials, and insulation drainage panels from single source from single manufacturer.

2.2 SHEET WATERPROOFING

A. EPDM Rubber Sheet: ASTM D6134, Type I, 60-mil- (1.5-mm-) thick flexible sheet, unreinforced, formed from EPDM.

2.3 ACCESSORIES

A. Furnish accessory materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.

1. Furnish liquid-type accessory materials that comply with VOC limits of authorities having jurisdiction.

B. Concealed Sheet Flashing: Same material, construction, and thickness as sheet waterproofing or 60-mil- (1.5-mm-) thick, uncured EPDM, as required by manufacturer.

C. Exposed Sheet Flashing: 60-mil- (1.5-mm-) thick EPDM, cured or uncured, as required by manufacturer.

D. Bonding Adhesives: For bonding waterproofing sheets and sheet flashings to substrates and projections.

E. Splicing Cement and Cleaner: Single-component butyl splicing cement and solvent-based splice cleaner.

1. Butyl Gum Tape: 30-mil- (0.76-mm-) thick by 6-1/4-inch- (160-mm-) wide, uncured butyl with polyethylene release film.

F. Lap Sealant: Single-component sealant.

G. In-Seam Sealant: Single-component sealant.

H. Water-Cutoff Mastic: Butyl mastic sealant.

I. Waterproofing and Sheet-Flashing Accessories: Sealants, pourable sealers, cone and vent flashings, inside and outside corner flashings, termination reglets, and other accessories recommended by waterproofing manufacturer for intended use.

J. Metal Termination Bars: Manufacturer's standard aluminum bars, approximately 1 inch (25 mm) wide, prepunched, with fasteners.

K. Semirigid sheets of asphalt-impregnated organic mat, mineral surface, with a nominal thickness of 1/8 inch (3 mm).

L. Fan folded, with a core of extruded-polystyrene board insulation, a nominal thickness of 1/4 inch (6 mm), and a compressive strength of not less than 8 psi (55 kPa).

2.4 INSULATION DRAINAGE PANELS

A. Insulation: Comply with Section 072100 "Thermal Insulation" for general building insulation, including insulation drainage panels.

B. Geotextile-Faced, Wall-Insulation Type VI, Drainage Panels: Extruded-polystyrene board insulation in accordance with ASTM C578, Type VI, 40 psi (276 kPa) minimum compressive strength; fabricated with tongue-and-groove edges and with one side having grooved drainage channels faced with nonwoven geotextile filter fabric.
1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of waterproofing.

1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method in accordance with ASTM D4263.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.

E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks in accordance with ASTM D4258.

F. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions.

3.3 INSTALLATION OF FULLY ADHERED SHEET

A. Install fully adhered sheets over entire area to receive waterproofing according to manufacturer's written instructions and in accordance with recommendations in ASTM D5843.

B. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required. Stagger end laps.

C. Apply bonding adhesive to substrates at required rate and allow it to partially dry.

D. Apply bonding adhesive to sheets and firmly adhere sheets to substrates. Do not apply bonding adhesive to splice area of sheet.

E. Install fully adhered sheets and accessory materials to tie into existing waterproofing.

F. Repair tears, voids, and lapped seams in waterproofing that do not comply with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending beyond repaired areas in all directions.

3.4 INSTALLATION OF SEAMS

A. Cement Splice: Clean splice areas, apply splicing cement and in-seam sealant, and firmly roll side and end laps of overlapping sheets according to manufacturer's written instructions to produce a splice not less than 6 inches (150 mm) wide and to ensure a watertight seam installation. Apply lap sealant and seal edges of sheet terminations.

3.5 INSTALLATION OF SHEET FLASHING

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to waterproofing manufacturer's written instructions.

B. Form wall flashings using exposed sheet flashing.

C. Extend deck sheet waterproofing to form wall flashings.

1. Flash penetrations and field-formed inside and outside corners with uncured sheet flashing.

2. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight installation. Apply lap sealant and seal edges of sheet-flashing terminations.

D. Cover expansion joints and discontinuous deck-to-wall or deck-to-deck joints by extending deck sheet waterproofing over joints.

E. Terminate and seal top of sheet flashings with mechanically anchored termination bars.

3.6 INSTALLATION OF PROTECTION COURSE

A. Install protection course over waterproofing membrane according to manufacturer's written instructions and before beginning subsequent construction operations. Minimize exposure of membrane.

1. Insulation drainage panels may be used in place of a separate protection course for vertical applications when approved by waterproofing manufacturer.

3.7 INSTALLATION OF INSULATION DRAINAGE PANEL

A. Install insulation drainage panels over waterproofed surfaces. Cut and fit to within 3/4 inch (19 mm) of projections and penetrations.

B. Ensure that drainage channels are aligned and free of obstructions.

C. On vertical surfaces, set insulation drainage panels in adhesive or tape applied according to manufacturer's written instructions.

D. On horizontal surfaces, loosely lay insulation drainage panels according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests.

B. Manufacturer's Field Service: Engage a full-time site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components; and to furnish daily reports to Architect.

C. Waterproofing will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.9 PROTECTION, REPAIR, AND CLEANING

A. Do not permit foot or vehicular traffic on unprotected membrane.

B. Protect waterproofing from damage and wear during remainder of construction period.

C. Protect installed insulation drainage panels from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

D. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

E. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION 071353

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hinges.
2. Mortise locks.
3. Surface bolts.
4. Manual flush bolts.
5. Exit devices and auxiliary items.
6. Lock cylinders.
7. Coordinators.
8. Astragals.
9. Surface closers.
10. Overhead stops and holders.
11. Door gasketing.
12. Thresholds.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Conference participants must include Installer's Architectural Hardware Consultant and Owner's security consultant.

B. Keying Conference: Conduct conference at Project site

1. Conference participants must include Installer's Architectural Hardware Consultant and Owner's security consultant.
2. Incorporate conference decisions into keying schedule after reviewing door hardware keying system, including, but not limited to, the following:

a. Flow of traffic and degree of security required.
b. Preliminary key system schematic diagram.
c. Requirements for key control system.
d. Requirements for access control.
e. Address for delivery of keys.

1.3 ACTION SUBMITTALS

A. Product Data Submittals: For each product.

B. Door Hardware Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant. Installer to be familiar with and propose products coordinated with current campus installations. Coordinate door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware. Schedule to be submitted and approved by Owner in coordination with existing products, materials and operations on site.

1. Submittal Sequence: Submit door hardware schedule concurrent with submissions of product data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
2. Format: Use same scheduling sequence and format and use same door numbers as in door hardware schedule in the Contract Documents.
3. Content: Include the following information:

    a. Identification number, location, hand, fire rating, size, and material of each door and frame.
    b. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
    c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.

C. Keying Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For compliance with accessibility requirements, for tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.

B. Field quality-control reports.

C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals.

B. Schedules: Final door hardware and keying schedule.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult Contractor, Architect, and Owner about door hardware and keying.

1. Warehousing Facilities: In Project's vicinity.
2. Scheduling Responsibility: Preparation of door hardware and keying schedule.
3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as a Door and Hardware Specification Consultant (DHSC).

1.7 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lockup for door hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

D. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures, including excessive deflection, cracking, or breakage.
b. Faulty operation of doors and door hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Three years from date of Substantial Completion. unless otherwise indicated below:

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain each type of door hardware from single manufacturer.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Where fire-rated doors are indicated, provide door hardware complying with NFPA 80 that is listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.

B. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that complies with requirements of assemblies tested in accordance with UL 1784 and installed in compliance with NFPA 105.

1. Air-Leakage Rate: Maximum air leakage of 0.3 cfm per sq. ft. (3 cu. m per minute/sq. m) at the tested pressure differential of 0.3 inch wg (75 Pa) of water.

C. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

D. Accessibility Requirements: For door hardware on doors in an accessible route, comply with ICC A117.1

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22.2 N).
2. Comply with the following maximum opening-force requirements:

a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
b. Sliding or Folding Doors: 5 lbf (22.2 N) applied parallel to door at latch.
c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.
4. Adjust door closer sweep periods so that, from an open position of 90 degrees, the door will take at least 5 seconds to move to a position of 12 degrees from the latch.
5. Adjust spring hinges so that, from an open position of 70 degrees, the door will take at least 1.5 seconds to move to the closed position.

2.3 HINGES

A. Hinges: ANSI/BHMA A156.1.

2.4 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in door hardware schedule.

B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

1. Bored Locks: Minimum 1/2-inch (13-mm) latchbolt throw.
2. Mortise Locks: Minimum 3/4-inch (19-mm) latchbolt throw.
3. Deadbolts: Minimum 1.25-inch (32-mm) bolt throw.

C. Lock Backset: 2-3/4 inches (70 mm) unless otherwise indicated.

D. Lock Trim:

1. Description: Match Owner's Standard

E. Strikes: Match Owner's Standard

F. Bored Locks: ANSI/BHMA A156.2, Grade 1 Series 4000.

G. Mortise Locks: ANSI/BHMA A156.13, Security Grade 1 stamped steel case with steel or brass parts; Series 1000.

2.5 MANUAL FLUSH BOLTS

A. Manual Flush Bolts: ANSI/BHMA A156.16; minimum 3/4-inch (19-mm) throw; designed for mortising into door edge.

2.6 EXIT DEVICES AND AUXILIARY ITEMS

A. Exit Devices and Auxiliary Items: ANSI/BHMA A156.3.

2.7 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver. Provide cylinder from same manufacturer of locking devices.

B. Standard Lock Cylinders: ANSI/BHMA A156.5, Grade 1 permanent cores; face finished to match lockset.

1. For interior doors

2. Core Type: Removeable.

C. High-Security Lock Cylinders: ANSI/BHMA A156.30, Grade 1 permanent cores that are removable; face finished to match lockset.

1. For exterior doors and gates

2. Type M, mechanical.

D. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.

E. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

2.8 KEYING

A. Keying System: Factory registered, complying with guidelines in ANSI/BHMA A156.28, appendix. Provide one extra key blank for each lock. Incorporate decisions made in keying conference.

B. Keys: Nickel silver.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

a. Notation: Information to be furnished by Owner.

2.9 OPERATING TRIM

A. Operating Trim: ANSI/BHMA A156.6; stainless steel unless otherwise indicated.

2.10 ACCESSORIES FOR PAIRS OF DOORS

A. Coordinators: ANSI/BHMA A156.3; consisting of active-leaf, hold-open lever, and inactive-leaf release trigger; fabricated from steel with nylon-coated strike plates; with built-in, adjustable safety release; and with internal override.

B. Carry-Open Bars: ANSI/BHMA A156.3; prevent the inactive leaf from opening before the active leaf; provide polished brass or bronze carry-open bars with strike plate for inactive leaves of pairs of doors unless automatic or self-latching bolts are used.

C. Astragals: ANSI/BHMA A156.22.

2.11 SURFACE CLOSERS

A. Surface Closers: ANSI/BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure

to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

2.12 MECHANICAL STOPS AND HOLDERS

A. Wall- and Floor-Mounted Stops: ANSI/BHMA A156.16.

2.13 DOOR GASKETING

A. Door Gasketing: ANSI/BHMA A156.22; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

B. Maximum Air Leakage: When tested in accordance with ASTM E283/E283M with tested pressure differential of 0.3 inch wg (75 Pa), as follows:

1. Smoke-Rated Gasketing: 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) of door opening.
2. Gasketing on Single Doors: 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) of door opening.
3. Gasketing on Double Doors: 0.50 cfm per ft. (0.000774 cu. m/s per m) of door opening.

2.14 THRESHOLDS

A. Thresholds: ANSI/BHMA A156.21; fabricated to full width of opening indicated.

2.15 AUXILIARY DOOR HARDWARE

A. Auxiliary Door Hardware: ANSI/BHMA A156.16.

2.16 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rating labels and as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and ANSI/BHMA A156.18.

C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended; however, aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Fire-Rated Applications:

    a. Steel Through Bolts: For the following unless door blocking is provided:

        1) Surface hinges to doors.
        2) Closers to doors and frames.
        3) Surface-mounted exit devices.

3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
4. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.17 FINISHES

A. Provide finishes complying with ANSI/BHMA A156.18 as indicated in door hardware schedule.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Steel Doors and Frames: For surface-applied door hardware, drill and tap doors and frames in accordance with ANSI/SDI A250.6.

B. Wood Doors: Comply with door and hardware manufacturers' written instructions.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches (760 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule, but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches (760 mm) of door height greater than 90 inches (2286 mm).

E. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as directed by Owner.
2. Furnish permanent cores to Owner for installation.

F. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."

G. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

H. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

1. Do not notch perimeter gasketing to install other surface-applied hardware.

I. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

J. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 FIELD QUALITY CONTROL

A. Independent Architectural Hardware Consultant: Engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
2. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 70 degrees and so that closing time complies with accessibility requirements of authorities having jurisdiction.
3. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.

B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant is to examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.6 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.7 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Maintenance Service: Beginning at Substantial Completion, maintenance service is to include 12 months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door and door hardware operation. Parts and supplies are to be manufacturer's authorized replacement parts and supplies.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain door hardware.

3.9 DOOR HARDWARE SCHEDULE

A. Refer to schedule in drawing set

END OF SECTION 087100

SECTION 261326 – MEDIUM VOLTAGE METALCLAD SWITCHGEAR

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section. The quotation documents shall include the following:

1. Total price of all purchased equipment
2. Separate “optional adder” prices as detailed in this specfication.
3. Clarifications and exceptions to this specification or the drawings.
4. Length of warranty inclduing details of the warranty.

1.2 SUMMARY

A. Provide two separate medium voltage switchgear lineups per drawings. Both are 15 kV rated (13.8 kV system voltage), 3-phase, 3-wire, solidly grounded at the transformer only (no neutral bus in the switchgear), 60 Hz metal-clad, drawout, vacuum interrupter, circuit-breaker switchgear with the following components, features, and accessories:

1. Copper, silver-plated main bus.
2. Relays.
3. Station Class Surge Arresters (Mains Only).
4. Provisions for future devices.
5. NEMA 1 enclosure
6. UL labeling
7. Suitable for service entrance equipment.

1.3 REFERENCES

A. ASTM (ASTM): ASTM B187 "Standard Specification for Copper, Bus Bar, Rod, and Shapes".

1. Code of Federal Regulations (CFR):

   a) CFR 47 Parts 15 and 18, Code of Federal Regulations - Federal Communications Commission (FCC) Rules and Regulations pertaining to EMI.

2. Institute of Electrical and Electronics Engineers, Inc. (IEEE):

   a) ANSI/IEEE C37.010 - "Application Guide for AC High Voltage Circuit Breakers > 1000VAC Rated on a Symmetrical Current Basis."
   b) IEEE C37.04 - "IEEE Standard Rating Structure for AC High-Voltage Circuit Breakers"

c) IEEE C37.06 – “IEEE Standard for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis— Preferred Ratings and Related Required Capabilities for Voltages Above 1000 V”
d) IEEE C37.2 - "Electrical Power System Device Function Numbers, Acronyms, and Contact Designations".
e) C37.20.2 - "Metal Clad Switchgear"
f) IEEE C37.21 - "Control Switchboards"
g) IEEE C37.90 - Relays and Relay Systems Associated with Electric Power Apparatus.
h) IEEE C37.100 - "IEEE Standard Definitions for Power Switchgear"
i) IEEE C57.13 – “IEEE Standard Requirements for Instrument Transformers”
j) IEEE-1613: Environmental and Testing Requirements for Communications Networking Devices Installed in Electric Power Substations

3. International Electrotechnical Commission (IEC):

a) IEC 60068-2: Environmental Tests
b) IEC 60255-21: Vibration and shock Tests
c) IEC-60255-22: RFI and Interference Tests
d) 60825-1: Laser (LED) Safety
e) IEC-61000-4: Electromagnetic Compatibility
f) IEC-61000-6: Electromagnetic Compatibility
g) IEC-61850 Series: Communication Networks and Systems for Power Utility Automation

4. National Electrical Contractors Association (NECA):

a) NECA 430-2016 Standard for Installing and Maintaining Medium-Voltage Switchgear

5. National Electrical Manufacturers Association (NEMA):

a) NEMA SG 4 - "Alternating Current High Voltage Circuit Breakers".
b) NEMA C37.55 "Conformance Test Procedures for Switchgear – Medium Voltage Metal Clad Assemblies".

6. National Fire Protection Association (NFPA):

a) NFPA 70 - "National Electrical Code" (copyrighted by NFPA, ANSI approved) hereinafter referred to as NEC.
b) NFPA 70B - "Recommended Practice for Electrical Equipment Maintenance" (copyrighted by NFPA, ANSI approved).
c) NFPA 70E – “Standard for Electrical Safety In The Workplace” (copyrighted by NFPA, ANSI approved) hereinafter referred to as NEC.

7. Underwriters Laboratories, Inc. (UL):

a) UL 486A-B - "UL Standard for Safety Wire Connectors.

1.4 SITE CONDITIONS

A. Seismic Loads

1. The switchgear must be capable of withstanding the forces listed in the International Building Code, IBC-the most recent edition for the Columbia, Missouri seismic zone, in addition to any other applicable codes. The vendor shall include signed and sealed data in a drawing or a report to confirm the switchgear meets these requirements.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's product data showing material and equipment proposed. Approval drawings prior to release for manufacturing are required.

1. Product data shall include, but shall not be limited to, the following equipment and materials:

a) Circuit breakers.
b) Buses.
c) Instrument Transformers.
d) Control, Relaying, test switches, relays, and Metering equipment.
e) Wire and cable.
f) Station Class Surge Arresters.
g) Fuses.

2. The ratings for the equipment shall include, but shall not be limited to, the following:

a) Voltages.
b) Frequency.
c) Number of phases.
d) Current, continuous and interrupting.
e) Accuracy.
f) Power requirements.
g) Power losses at full and half load.

3. Physical characteristics and materials shall include, but shall not be limited to, the following:

a) Size/dimensions.
b) Weight.
c) Finishes.

4. Accessories shall include, but shall not be limited to, the following:

a) Indicating lights.
b) Terminal blocks.
c) Test switches.
d) Auxiliary contacts.

B. Shop Drawings: Submit complete shop drawings as required to determine acceptability. Shop drawings shall include, but shall not be limited to, the following:

1. Bill of materials and components.
2. Outline drawings, dimensioned plans, elevations, sections, supports, materials, and finishes, showing weights, bolt spacing, clearances, tolerances, conduit, cable entrances, terminal strips, and methods of assembly.
3. Cubicle and compartment layouts.
4. Bus and circuit breaker ratings and arrangements including dimensions of bus bars, including the ground bus, and the type and spacing of bus supports.
5. Nameplate details (size and legend).
6. Detail drawings showing incoming line terminations and location of cable termination with dimensions. Shop drawings shall verify sufficient conductor space and compliance with codes.
7. Mimic bus diagram showing it installed on the front of the switchgear.
8. Shipping arrangements and packaging methods.

C. Wiring Diagrams: Submit with shop drawings, specific wiring diagrams and instructions for equipment, controls, communications, or devices which are furnished, or which are to be field wired and connected. The diagrams and instructions shall not be of a general or typical nature, but shall be applicable only to this Project. Include identical diagrams and instructions to install the equipment as are included in the operating and maintenance manuals. Wiring diagrams shall include, but shall not be limited to, the following:

1. Single- and three-line diagrams.
2. Electrical wiring diagrams for communications, instrumentation, metering and relaying.
3. Control schematic diagrams including interface diagrams having terminals identified for remote equipment.

    a) Indicate all field wires with Cable Tag, Size, Color, Equipment To, Equipment From per Jacobs cable schedule, in addition to Terminal Block, and Terminal Number where wire is to be landed. In the case that a cable is required but not indicated on Jacobs cable schedule, notify engineer and cable information shall be provided.

4. Wiring diagrams for switchgear showing connections to distribution branches.

D. Calculations: Submit calculations supporting the selection of the devices and components if being furnished. Devices requiring submittal of calculations shall include, but shall not be limited to, the following:

1. Instrument Transformers: Sizes and burdens.
2. Control power transformers.
3. DC Power System components.
4. Low Voltage AC Power system components.
5. Seismic withstand calculations.

E. Operating and Maintenance Manuals: Prepare and deliver complete operating and maintenance manuals. Provide information pertinent to the equipment for preventive maintenance and for replacement of expendable components. Manuals shall include the items listed below and other information recommended by the manufacturer:

1. Manufacturer's published information.
2. Set of shop drawings.
3. Wiring diagrams of electrical components.
4. Acceptance test reports.
5. Electrical characteristics and ratings of components.
6. Recommended spare parts list.
7. Maintenance Procedures
8. Complete list of parts.
9. Factory Test Data: Provide factory test data certified by a professional engineer that switchgear test results fulfill the specified requirements.

F. Submit with proposals.

1. Preliminary Data Sheets.
2. Preliminary one-line diagrams.
3. Elevations showing overall dimensions, weights, and layout of accessories.
4. Conduit area availability in both top and bottom of switchgear for power and control/communication cable/wires.
5. Bill of materials for each cubicle with manufacturer reference number.
6. Complete list of spare parts and special tools that will be furnished with equipment, which are included in lump sum price. In addition, provide an itemized price listing of recommended spare parts with prices guaranteed for at least 1 year after acceptance of equipment.
7. Complete data and listing of items requiring field assembly and installation and special equipment required.
8. Manufacturer’s ISO certification certificate.
9. Location of manufacture of each unit.
10. Circuit Breaker control power requirements for 125VDC: close current coil (amps), trip coil (amps), spring charge motor current (amps) and maximum run duration (seconds), close voltage operation range (volts), trip voltage range (volts).

G. Submit after Notice of Award

1. Certified Data Sheets.
2. Master drawing index.
3. One-line diagrams.
4. Three-line diagrams.
5. Conduit entry and exit locations.
6. Schematic diagrams and elementary wiring and connection diagrams.
7. Control and equipment wire terminations.
8. Material lists with manufacturer reference numbers.
9. Ratings and nameplate schedules.
10. Elevations showing overall dimensions, weights, and layout of accessories.
11. Switchgear cross-sections to indicate interior bus arrangement and equipment locations.
12. Floor plan drawing showing location for anchor bolts and leveling channels.
13. Location of floor and pad openings required for entrance of conduits and cables.

14. Performance curves for each ratio and type of current and voltage transformer.
15. Detailed instruction books for all equipment, meters, and each type of relay.
16. Detailed characteristics of surge arresters.
17. Detailed procedures and processes for factory acceptance tests.
18. Certified test report of manufacturer's standard production tests

H. Submittal Review

1. Allow for minimum of two full weeks (14 calendar days, 10 working days) owner and EOR to review all submittals.
2. Owner reserves the right to perform an onsite review of shop drawings.
3. Provide the price per day of shop drawing review at the factory and switchgear inspection. The cost of customer travel expenses shall be the responsibility of the customer. The manufacturer normal M-F business hours are assumed.

1.6 SYSTEM DESCRIPTION

A. Provide complete free-standing assembly as shown on drawings consisting of circuit breakers, fuses, protective relays and control devices for operation and control of the distribution feeders, tie breaker(s) and the main breaker(s).

1.7 QUALITY ASSURANCE

A. After fabrication, perform an operational test in the manufacturer's plant to check out the entire system before delivery. Include calibration of meters, operation of temperature sensors, relays and device settings; control wiring, including polarity, of all instrument transformers; complete assembly and control function testing. Submit certified written test reports.

B. Provide manufacturer's certification that materials meet or exceed minimum requirements as specified.

C. The Manufacturer shall have in place a complete and functioning comprehensive Quality Assurance program covering the design, procurement, fabrication, packaging and delivery of the specified equipment and materials. This program shall ensure that the equipment and materials furnished by the Manufacturer meet the requirements of this Specification as well as the Manufacturer’s own procedures and processes.

D. It shall be the Manufacturer's responsibility to ensure that the Suppliers, Sub-Suppliers and Sub-Contractors meet the intent of this requirement and are able to demonstrate their compliance.

E. The owner reserves the right to reject equipment and/or components which require major alteration to meet specifications.

F. Non-conformances to this Specification and major equipment or component repairs that occur shall be documented and approved by the Owner in writing prior to testing and shipment.

G. Retain first paragraph below to allow drawing details based on one manufacturer's product to establish requirements and still allow competition. Coordinate with Division 01 requirements.

H. 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.

I. Provide written data certifying a minimum of ten years' experience in the building of metal clad switchgear and at least ten successful working installations of this type of equipment.

1.8 WARRANTY

A. The manufacturer shall provide a warranty against defects in material and workmanship for a period of 36 months after shipment or 30 months from the date of commissioning, whichever occurs first. During the warranty period, there shall be no cost to the owner for any corrective repairs.

B. Provide Owner with any additional component warranty information in excess of the above.

1.9 DELIVERY, STORAGE, AND HANDLING

A. The shipping sections of all switchgear shall be broken down into sections to allow moving equipment through openings into the electrical room.

B. All shipments shall be wrapped in plastic.

C. Gravity and tilt recording meters shall be provided on all shipments to ensure equipment was handled properly during transport.

1.10 COORDINATION

A. Coordinate layout and installation of switchgear and components with other construction including conduit, equipment, and adjacent surfaces of electrical room.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers:

1. Powell Industries.

2.2 GENERAL

A. Standards: The switchgear shall consist of stationary steel structures containing vacuum type, drawout power circuit breakers with overcurrent devices, instruments, buses, and system control devices. The switchgear shall be UL approved as service entrance equipment and designed, built, and tested in accordance with ANSI/IEEE and NEMA standards for metal clad switchgear.

B. Unless otherwise specified this equipment is intended for use in temperature-controlled building.

C. This equipment is intended for use in an area where the elevation is less than 3300 feet above sea level. Above 3300 feet a de-rating factor as prescribed by ANSI standards will apply.

D. The switchgear shall be suitable, tested and certified to meet all applicable seismic requirements of the latest International Building Code specifically for seismic zone requirements.

2.3 SWITCHGEAR RATINGS:

A. Rated Maximum Voltage: 15 kV.

B. Power Frequency: 60 hertz.

C. System Voltage: 13.8 kV.

D. Phase: Three.

E. System: Three phase, 3-wire, neutral solidly grounded at each transformer (no neutral bus in switchgear).

F. Rated Voltage Range Factor (k): 1.0.

G. Rated Continuous Current:

1. Main Bus: 3000A
2. Main and Bus Tie Breakers: 2000A
3. Feeder Breakers: 1200A

H. Interrupting time: 3 Cycles

I. Rated short-circuit and short-time current:36 kAIC

J. Closing and Latching Capability: 130 kA peak

K. Low Frequency Withstand Voltage Insulation Level: 36 kV.

L. Impulse Withstand Voltage Insulation Level: 95 kV.

M. Nominal Control Voltage: 125 volts DC for close, trip, and spring motor operation. Customer provided power.

2.4 ENCLOSURE

A. Vertical Sections: The stationary enclosure shall consist of self supported, vertical sections housing circuit breakers, buses, cables, system controls, and accessories. The vertical sections shall be bolted together to form a rigid metal clad switchgear assembly. The vertical sections shall have separate front compartments for circuit breakers and controls, and rear compartments for buses and outgoing cables. The vertical section framework shall consist of a welded and bolted steel frame with reinforcing gussets. Assembled to this framework shall be doors and top, side, and rear covers.

B. Base: The vertical sections shall be supported on a steel base assembly consisting of die formed steel and commercial channel welded and bolted together. The base shall provide a rigid support for the switchgear assembly.

C. Each front and rear compartment door shall be provided with a formed steel hinged door with hand operated heavy duty door latches with 'T' handles, see below for example photo. Each door shall have provisions for padlocking. Rear doors with 3-point latching for access to cable compartments. Rear doors shall be equipped with IR viewing windows with removable dustproof covers; two high sections shall include IR viewing windows for each upper and lower compartment. Each breaker cubicle front door shall have a manual "Pull To Trip" switch with spring cover, see below for example photo.

D. Lifting Equipment: Circuit breaker lifting equipment shall be provided to remove circuit breakers. The equipment shall be a portable lifting device manufactured by the equipment supplier.

E. Breaker Compartment: The front compartment of the switchgear shall contain the drawout circuit breakers. Each vertical feeder section shall provide the space to accommodate two circuit breakers if frame size allows. Each circuit breaker shall be mounted in a barriered cell. Breaker

compartments for future use as indicated as “SPACE” on the drawings, shall be fully equipped with drawout assemblies and current carrying parts required to permit completion of the unit by the addition of only a circuit breaker. Provide an LED light source in the top and bottom of the front and rear compartments operated by a light switch on the door.

F. Cable Compartment: The cable compartment shall be sized to accommodate incoming and outgoing cables or busway required for each vertical section. The bus compartment shall be segregated from the feeder cable compartment by means of grounded metal barriers. The cable compartment shall also contain a copper ground bus bolted directly to the switchgear frame. The incoming main breaker, tie breaker, and feeder breaker cable compartments shall be capable of terminating the correct quantity of copper cables with NEMA 2 hole compression lugs and sizes as noted on the contract drawings up to 6-750 kcmil, 15 kV, MV-105, 133% insulated conductors at a minimum. The depth of the finished equipment shall be sufficient to allow for entrance, bending, and termination of power cables. Individual units shall be provided for bottom entrance. A minimum of 26 inches of vertical clearance between terminal pads and the cable entrance shall be provided. Two high sections shall provide a separate chute or channel to isolate and route bottom entry cables to upper compartments. The quantity of lugs per phase provided shall be based on MV-105, 15kV cable, Cu conductor, type EPR insulation, with 133% concentric neutral. Terminal pads shall be provided with cable support.

G. Each switchgear cubicle shall have at a minimum 11-gauge sheet steel side panels. Construction shall provide two (2) steel sheets between adjacent sections so as to minimize the chance of fault propagation between sections.

H. Provide electric heaters in each switchgear compartment.

1. Voltage: 240 Volt single-phase operated at 120V from an external source.
2. Watts: As required to maintain temperature.
3. Provide thermostat for each compartment with a minimum set point of 50°F.

I. Finish: Indoor: The switchgear enclosure parts shall be given an iron phosphate pretreatment, a primer, and a coat of baked enamel. After assembly, a finish coat of air-drying enamel of gray color (ANSI #61) shall be applied to exterior surfaces.

2.5 BUSES

A. General: The bus structure shall consist of copper bus with silver plated bolted connections mounted on track resistant glass polyester and porcelain insulators. The bus system shall be insulated with fluidized bed epoxy insulation. The copper bus shall be of sufficient size to limit the temperature rise as specified in ANSI/IEEE C37.20.2. Bus bracing shall be adequate to withstand mechanical and thermal stresses due to short circuits at least equal to those specified for the main circuit breaker. Provide ASTM B 187 copper throughout the switchgear. Bus joints shall be provided in each unit. The temperature rise of the bus and connections shall be in accordance with ANSI standards and documented by a design test.

B. Provide removable insulating covers for line and load terminations.

C. Power bus orientation shall be 1-2-3 top to bottom, front to back, and left to right when viewed from the front of the switchgear.

D. Phase Buses: Provide continuous phase buses for the full length of the switchgear lineup. Tap buses shall have the same ampacity as the section design rating.

E. Ground Bus: Provide a minimum size ground bus of 2 inch by 1/4-inch cross sectional area, for the full length of the switchgear lineup. Provide compression indent type lugs to accept No. 4/0 AWG copper cable.

F. Connections: Bus connections for shipping breaks, extension, and taps shall be silver plated bolted pressure joints. Provide insulating boots for bus joints and cable terminations. Selection of cable termination boots to be based on installed cable diameter (15kV cable terminations will be live skirted terminations 3M QT-III).

G. All cables will be entering and exiting the botom of the switchgear.

H. Safety Shutters: The switchgear shall be furnished with grounded shutters or a means by which to cover the stationary primary disconnects when the breaker is moved from the connected position.

2.6 POWER CIRCUIT BREAKERS

A. General: The power circuit breakers shall be medium voltage, drawout, vacuum circuit breaker type, having electrically charged, stored energy mechanisms which shall be mechanically and electrically trip free. Provision shall be included for manual charging of the operating mechanism. The breakers shall be mounted on a rigid, self-aligning drawout mechanism. The breaker shall be removable and shall roll out on horizontal guide rails. All breakers shall be the 3-cycle.

B. Trip coils:

1. Provide dual trip coils for main and tie breakers.

    a) Provide one of the “SPARE” breakers rated at 2000A with dual trip coils mounted in Spare 1200A cubicle for each line-up per drawings.

2. Provide single trip coil for feeder breakers.

C. Breaker Positions: Each drawout breaker shall be provided with three position operation. Each position shall be clearly identified by an indicator on the circuit breaker front panel.

1. Connected Position: In the connected position, the main line and load terminals and auxiliary control contacts and circuitry shall be connected, and the breaker shall be fully operable. The breaker shall be interlocked to automatically trip before racking into or out of position.
2. Test Position: In the test position, the circuit breaker auxiliary control contacts are manually connected from the front of the breaker and circuitry only shall be connected to permit testing of the complete control system without actually connecting the sources or loads to the main bus. Control contacts are mechanically interlocked with the breaker.
3. Remove Position: In the remove position circuitry shall be disconnected and the breaker can be removed from the compartment.

D. Operating Mechanism:

1. The breaker operating mechanism shall be the two step, stored energy quick make, quick break type. The close operation of the circuit breaker shall automatically charge the opening springs. The operating mechanism shall be front located and designed for servicing without removing breaker from rails.
2. Manual charging of the breaker shall be possible by means of a manual charging lever.
3. Close trip indicator, mechanically connected to the breaker, shall be provided to indicate the breaker position.
4. Circuit breaker operating mechanism shall be completely trip free both mechanically and electrically. Mechanical tripping of a closed-circuit breaker shall be possible with the front cubicle door closed.
5. A contact wear gap indicator shall be provided and shall be easily visible.

E. Mechanical Interlocks: The switchgear shall be provided with mechanical interlocks to:

1. Prevent moving the breaker to or from the connected position when the breaker contacts are in the closed position.
2. Prevent closing the breaker unless the primary disconnects are fully engaged or the breaker is in the test or disconnect position.
3. Automatically discharge the closing springs when the breaker is moved between the connected and test positions or when it is inserted into or withdrawn from the compartment.

F. Mechanism Operator Cell Breaker Auxiliary Switches: Each circuit breaker shall be equipped with mechanism operated auxiliary switches which shall operate when the breaker is open or closed. These switches shall be enabled in the operating and test position. Provide four normally open and four normally closed contacts in addition to those required for the circuit breaker operating mechanism and control schemes. Wire all spare contacts to terminal blocks for customer use.

G. Truck Operated Cell Switches: Each breaker compartment shall be equipped with cell mounted switches which shall operate when the circuit breaker is levered into or out of the operating

position. Provide two six stage switches, each six-stage switch shall provide six normally open and six normally closed contacts. Wire all spare contacts to terminal blocks for customer use.

H. Breakers shall have secondary connections on the front of the breaker, see below for example photo.

I. A steel interference plate shall be mounted in the bottom of each circuit breaker cell assembly which only allows the same or higher rated circuit breaker (voltage, current, interrupting rating) to be inserted into a lower rated cell assembly.

J. For operator safety the circuit breaker shall have provision for padlocking it in the disconnected position.

K. Circuit breaker shall have the capability of racking between the connected, disconnected and test positions with the cubicle door closed.

L. Power circuit breakers shall be shipped and packaged separately from the switchgear structure.

M. The power circuit breaker ground connection must be capable of carrying the short circuit rating of the circuit breaker for a minimum of 2 seconds and must also be capable of withstanding the peak current value (or 2.7 times the rated short circuit current) of the circuit breaker.

2.7 REMOTE RACKING

A. Each metalclad switchgear lineup shall be provided with remote closed door racking provisions for all circuit breakers. Closed door racking provisions for circuit breakers shall not require the end user to install any extension arms through the door for operation of the racking mechanism. Each circuit breaker shall have integrated racking motor for this function. Cubicle mounted racking motor shall not be permitted.

1. Provide remote racking via HMI interface. Provide terminal blocks for field wiring to interface with HMI and control remote racking of each breaker.
2. Provide freestanding HMI shipped loose for installation in Control room.
3. Provide remote racking pendant with minimum ten (10) meter cord for remote racking by personnel in addition to remote racking by HMI. Pendant shall have Open, Close, Rack IN, and Rack OUT push buttons with LCD Display indicating breaker status.
4. Provide pad-lockable door mounted switch to enable/disable racking capability for that cubicle.

2.8 DIGITAL POWER MONITOR

A. Digital Main Meters (DMM): General metering information is to be available through the Schweitzer relays. In addition to devices below:

1. Provide single phase digital switchboard monitor Electro Industries F series or approved equal for each feeder cubicle equipped with a line side PT, not required on Mains or Ties.
2. MVSG-North:

a) Frequency Transducer: Ohio Semitronics Model AFT-060-10E (or equal). Provide twisted shielded pair for connection of transducer and logger.
b) Datalogger: Delphin Technology, Expert Logger 100.
c) ~~Bus voltage meter: Shark 250 part number Shark250-60-10-V1-D2-INP100S-X-X.~~

3

d) Dranetz PQ3000 power quality, Energy and Demand, and Process Monitoring.
3. MVSG-South:

a) Dranetz PQ3000 power quality, Energy and Demand, and Process Monitoring.
b) ~~Bus voltage meter: Shark 250 part number Shark250-60-10-V1-D2-INP100S-X-X.~~

2.9 CIRCUIT BREAKER MONITOR

A. Provide real-time circuit breaker data acquisition & diagnostics system. Circuit breaker monitoring system shall proactively monitor circuit breaker health by using advanced algorithms, analyzing past and present data, to determine equipment health and inform of potential problems. Circuit breaker monitor shall have a condition status light mounted in a clearly visible location on the inside of the breaker cubicle. Light shall be green for normal, yellow for warning, red for alarm. Provide USB diagnostics port on the front of each circuit breaker cubicle to allow for access of monitor with laptop computer without opening cubicle door. Provide licensed copy of software on USB drive. Circuit breaker monitor shall be provided with form C dry contact which operates when alarm function is triggered for external customer use. Wire contact to protective relay in that cubicle. Monitor shall capture the following data at a minimum:

1. Operating coil condition.
2. Mechanism operation.
3. Circuit breaker environmental conditions.
4. Thermal status of circuit breaker primary conductors.
5. Trip/close timing.
6. Charging motor condition.
7. Digital operation count.

B. For 2000A breakers provide fiber optic temperature monitoring system. System shall be designed and tested to comply with IEC 61010. Provide display unit with LCD screen and USB port. Monitor shall measure the temperature of all three phases on the line and bus side cable and bus terminations.

2.10 ACCESSORIES

A. Lockout Relays.

1. Electroswitch Type LOR Series 24, part number as indicated on Contract Drawings.
2. Integral LEDs:

    a) Lockout relay coil intact and ready – White.
    b) Lockout relay trip applied – Red.
    c) Rated operating trip voltage shall be low enough to allow coil operation at 75% of rated voltage.

3. Part number indicates number of decks, and therefore number of contacts.

B. Breaker Control switches.

1. Electroswitch Series 24.

    a) Rated operating trip voltage shall be low enough to allow coil operation at 75% of rated voltage.
    b) Pistol Grip handle.

C. Local/Remote Switch.

1. Electroswitch Series 24.
2. Oval Shank handle.
3. Contacts: Minimum 4 N.C. and 4 N.O, wired to terminal blocks for owner's use.

D. Circuit Breaker status lights (LED):

1. Open (Green).
2. Closed (Red).

E. Trip Coil Monitor:

1. SEL 2652 Trip Coil Monitor SEL Part Number 2652B5XX.
2. Trip Coil healthy LED: Blue.
3. Alarm contacts for trip coil discontinuity.
4. Quantity:

   a) Main and Tie: Two each.
   b) Feeder: One each.

5. Mounted in cubicle door

F. Kirk-Key Interlock:

1. Provide key interlock for capacitor bank circuit breaker cubicles. Key can only be removed with breaker racked out. Mount interlock in cubicle door. Key shall be operable with cubicle door closed. Interlock shall be Kirk-key brand or approved equal.
2. Lock shall be re-keyed in the field to match key provided by capacitor bank vendor.

2.11 ELECTRONIC PROTECTIVE RELAYS

A. Protective relays shall be Schweitzer Engineering Laboratories (SEL) as specified herein under the breaker type classification specification sections in this document. The relays shall meet the following performance requirements:

1. Standards: Shall meet applicable IEEE C37.90 and IEEE C37.2 standards.
2. Temperature Range: 2 degrees C (28 degrees F) to 55 degrees C (131 degrees F) (operating), 4 degrees C (25 degrees F) to 70 degrees C (158 degrees F) (storage).
3. Alarm Contact: Normally closed contact (contact closed if loss of power or self check failure).
4. The relays shall be capable of transmitting metering, event, alarm and status information to a RTAC controller.
5. Breaker Type:

   a) MVSG-NORTH and MVSG-SOUTH Bus Differential:

      1) SEL-787Z part number 0787Z001A1A1A0X85A6310110.
      2) Quantity: 2

b) Main Breaker:

1) SEL-700GT+ part number 0700GT1A1A1A7585A2C0.
2) Quantity: 2

c) MVSG-NORTH Tie Breaker:

1) SEL-751 part number 751201A1A1A7A85AF30.
2) Quantity: 1

d) MVSG-SOUTH Tie Breaker:

1) SEL-787 part number 07873SE1A1A1A7585A630.
2) Quantity: 1

e) Feeder Breakers:

1) SEL-751 part number 751201A1A1A7A85AF30
2) Quantity: 26

B. Manufacturer to supply a minimum of one (1) license for all software required to communicate with and set relays as well as analyze oscillography obtained from event reports. Provide 2 communication interface cables for each lineup. Fully optioned software for advanced analysis and setting capabilities is required. Minimal freeware versions of software will not be accepted.

C. Relay settings shall be determined by a coordination study provided by contractor. Refer to specification 260573.16.

D. The Main and Tie Breaker control logic is permitted to allow continuous paralleling of sources based on the sync-check relay (Device 25). See drawings for specific breaker control relay logic. (Information Note: a current limiting tie reactor is provided to limit campus symmetrical short circuit amps to 25kA or less.

2.12 DC OVERCURRENT CIRCUIT PROTECTION AND WIRING

A. All DC-fusing shall be ganged, + and -, in dead-front, “finger safe” shot-gun style pull-out type with lighted blown fuse indication visible from the front of the fuseblock.

B. Each metal-clad vacuum circuit breaker shall have a separate set of fuses for the trip circuit, close circuit, and relay power/inputs.

C. Customer provided DC circuit(s) shall terminate on finger safe disconnect switch then distributed to the individual breaker cubicles.

2.13 WIRING

A. Class B for stranding and flexibility for all control wiring, No. 14 AWG minimum (Current transformer wiring #10 AWG minimum).

B. Wiring over door hinges or other locations where leads may be subject to flexing shall employ the use of No. 14 AWG (minimum), 41 strand, extra flexible copper conductors.

C. Ring tongue type lugs connected on all control wiring except relay connections (wire ferrule for relay connections).

D. Terminal block connections used shall be GE Type EB=25 or similar style with terminal marking strip in the middle of the block. All current transformers terminal blocks (SCTB) shall be GE type EB-27 and shall terminate immediately into shorting terminal blocks with knurled conductive thumbscrews (one in each corner) for shorting out the current transformer. All CT taps shall be wired out to SCTB.

E. All wiring shall utilize mechanical fastening means only. The use of adhesives for fastening wiring to the switchgear or the use of adhesives for any purpose is not permitted.

F. Terminations:

1. Wiring shall not have more than two wires connected to a terminal point.

    a) Only one wire shall terminate on “phoenix” type connectors. (Back of SEL relays for example).

2. External wiring termination points for Owner’s connections shall be arranged for one wire to each terminal point.
3. Twenty percent (20%) spare terminal points shall be provided.
4. Terminal blocks shall be furnished and installed at switchgear splits or shipping splits for wiring reconnection at the jobsite. Shipping split connections shall be clearly tagged.

G. Wire Markings: Every wire shall have source and destination identification which shall be visible at each termination point. All wire marker identification shall use typewritten text. Wire markers shall be heat shrinkable or plastic interlocking sleeve type. The marker shall not be heat-shrinked in order to be able to turn the marker to get a better view of the marking. Cloth wire markers are not acceptable. Spare contacts on relays, lockout relays, control switches, etc., shall be assigned wire numbers, wired to terminal blocks, and labeled accordingly.

H. Methods: Hinge wiring shall be arranged so that any twisting shall take place in the longitudinal plane of the conductor, rather than across the conductor. Control wires shall be armored or enclosed in grounded metal troughs where they pass through primary compartments.

2.14 NETWORK CONNECTIONS

A. Provide DIN rail mounted keystone block for each external network connection as shown on drawings. Field wire external ethernet cable to keystone block.

1. Signamax Keystone Industrial DIN-Rail Mounting Module KI-DIN-RMM-SL.
2. Signamax Keystone Cat 6 MT-Series Unscreened Keystone Jacks KJ458MT-C6C-BK (Black).

B. Provide patch cord from keystone block to device.

1. Commscope GigaSPEED XL Stranded Cordage Modular Patch Cord.
2. Jacket:

    a) “A” Network: Yellow.
    b) “B” Network: Purple.
    c) EtherCAT: Orange.
    d) Control Room HMI PC: Blue.
    e) Other: Blue.

2.15 INSTRUMENT TRANSFORMERS

A. General: Instrument transformers shall be the type for switchgear installations. Transformers and associated components shall be in a drawout section

1. Voltage transformers and associated fuse assemblies shall be installed in drawout assemblies so that they may be readily disengaged from the power bus.
2. Where physical size restrictions do not allow the Voltage transformer to be mounted in a drawout assembly, the voltage transformer may be stationary mounted with the fuses only mounted in the drawout unit. The appropriate interlocks shall be provided to ensure maximum operator safety.
3. When moved to the withdrawn position, the transformer drawout unit shall automatically ground the transformer primary windings and the fuses. A visible indication of positive ground is required. The ground may be a momentary or sweeping action that occurs as the unit moved out of the connected position.
4. Voltage transformers shall have 120-volt secondaries unless otherwise specified.

    a) Voltage transformers shall have an accuracy rating comparable to the metering equipment and a burden capacity equal to twice the initial load.

5. Current limiting fuse protection shall be provided on the primary side of each Voltage transformer.
6. Voltage transformers shall be designed to withstand the basic impulse level of the switchgear.
7. ANSI accuracy class of 0.15 with burdens of W, X, and Y.
8. Provide fused access to secondary output of each Voltage transformer in a readily accessible dedicated terminal block for future connection to synchronization equipment.

B. Current Transformers

1. Unless specified otherwise, the polarity marking shall be towards the circuit breaker.
2. Each current transformer shall be rated to withstand the thermal and mechanical stresses imposed by the short circuit rating of the applied circuit breaker.
3. The secondary termination of current transformers shall be on a shorting terminal block.
4. Current transformers shall have a rated 5 ampere secondary current unless otherwise specified.
5. Current transformers shall be rated as shown on project drawings.
6. Bus differential protective current transformers shall be identical throughout the entire bus differential protective circuit as shown on the drawings with fixed ratio.
7. Relaying accuracy classification shall be suitable for the connected burden.
8. Current transformers, when installed, shall be fully rated for the appropriate voltage class.
9. Current transformers shall have a minimum thermal rating of 2.0.
10. Relaying CTs: refer to single line diagram for ratio.

a) Accuracy Class: ANSI 0.3S
b) Burden: B1.8
c) C200 at a minimum unless otherwise noted.
d) Multi-ratio with 5 taps.

2.16 TEST SWITCHES

A. Provide test switches with stud type terminals for metering and for all relays.

B. Test switches:

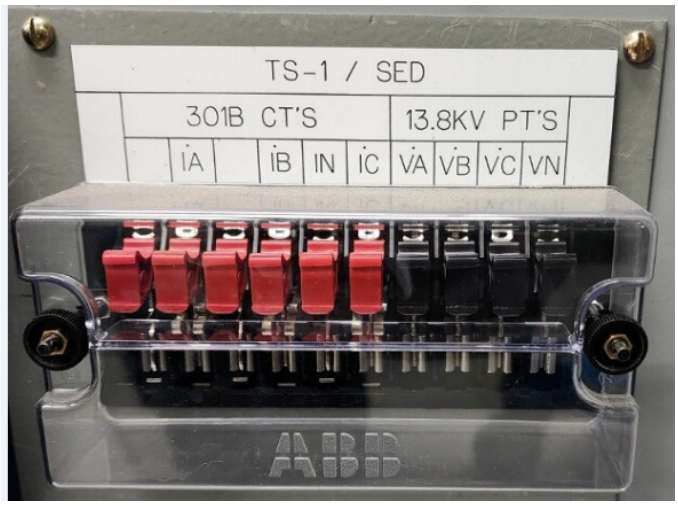
1. Knife blade test switch: 10-pole with Control Power, Voltage and Current elements as required, clear cover, ABB "Flexitest" Type FT-1, or equal.
2. Identify each voltage and each pair of current switches with a "V" or "I" and phase designation "A," "B," or "C" or ‘G’ with an engraved nameplate. (See example photo of test switch below-next page).
3. All trip circuit test switches shall be RED in color and labeled with an engraved nameplate according to relay output.
4. All test switches wired to current transformers shall be shorting type switch which shorts out the CT, make before break, when the switch is operated.

C. Extend 3-phase bus voltage circuits to all cubicles and combine with metering current transformer circuits on common test block for use with OWNER’s portable instruments.

D. Lockout test switches: 10 single-pole potential elements, cover, wired in series with coils and normally open contacts of lockout relays, ABB"Flexitest" Type FT-1, or equal.

E. Covers: Clear cover, shallow cover with thumbnuts.

F. FT Test Switches: White w/Black lettering. Handles color: Red for Outputs/Trips and CT’s, Black for all else. Refer to photo below for example:



2.17 NAMEPLATES

A. Nameplates shall be provided for each section, unit, instrument, transformer, light, meter, switch, control, terminal strip, rear panel mounted component (including fuses), fuse blocks, timers, relays, auxiliary relays, etc., in accordance with a nameplate schedule. Color coding shall be used for equipment and functional identification as indicated below.

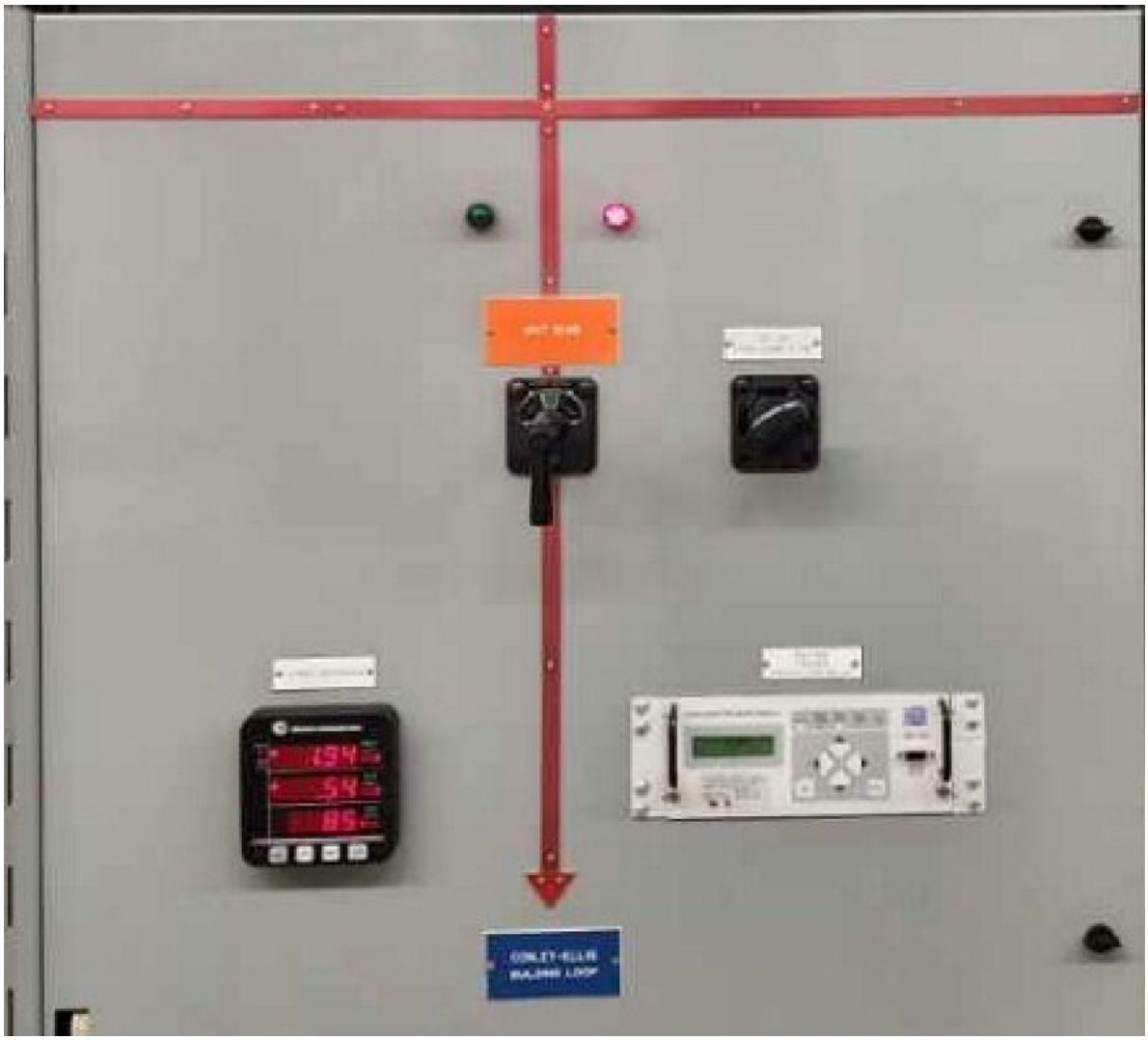
1. Manufacturer Nameplate shall be engraved (AL or SS) with Manufacture Date, order number, and Ratings. One for each vertical section in upper cubicle.
2. All other nameplates shall be laminated phenolic two-ply mplastic.
3. Characters shall be uniform block style not smaller than 1/2 inch for switchgear and not smaller than 1/4 inch for instrument transformers, relays, alarms, instruments, and control devices.

    a) Breaker Number: Orange background with white lettering (Duplicate on rear)
    b) Circuit Description: Blue with white lettering (Duplicate on rear)
    c) Device: White background with black lettering
    d) PT symbol: Red background with white lines.
    e) FT Test Switches: White background with Black lettering.

4. Nameplates shall be secured using No. 4, 36 RH stainless steel or nickel plated brass machine screws.

2.18 MIMIC BUS

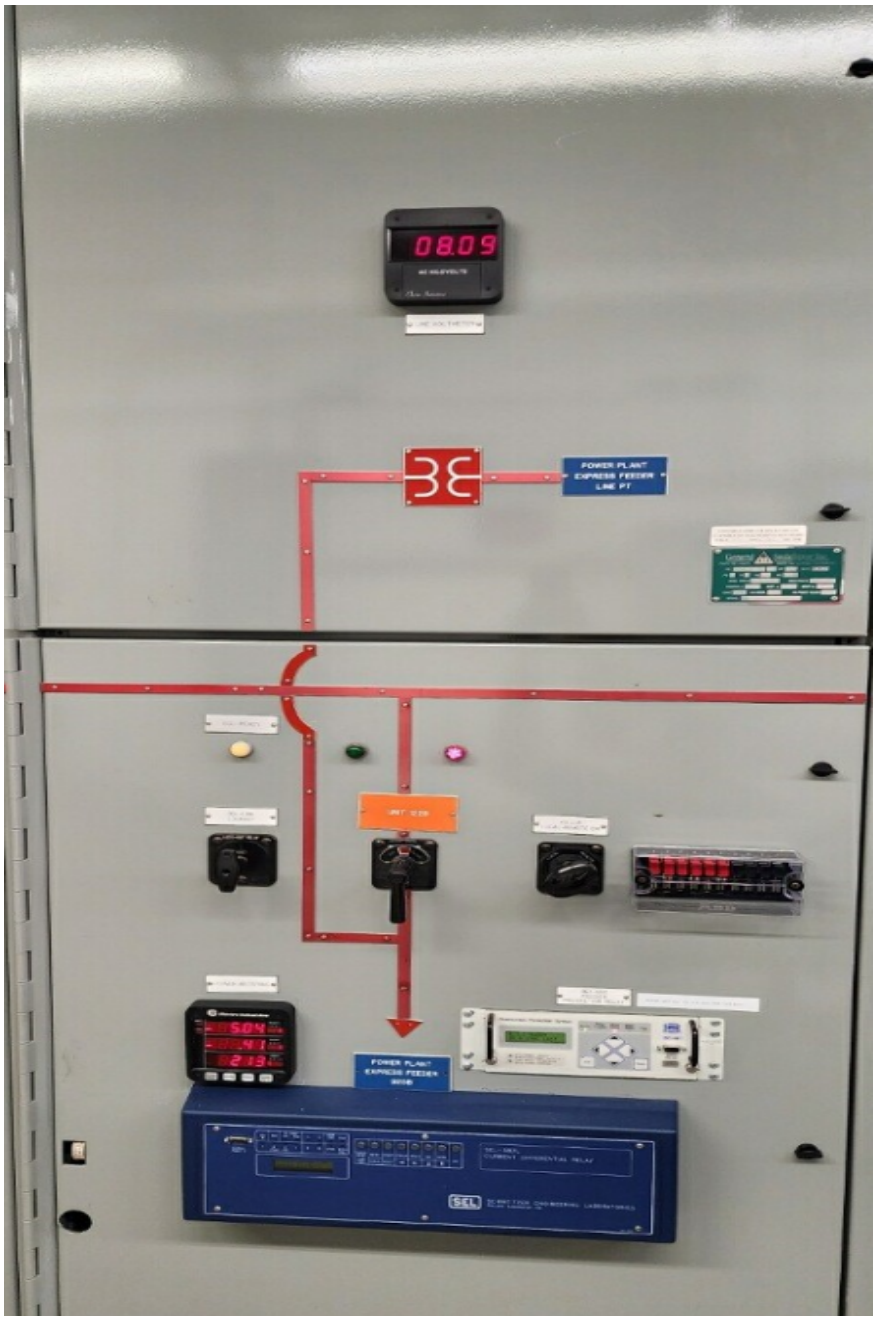
1. Mimic bus shall be provided in phenolic segments fastened using No. 4, 36 RH stainless steel or nickel plated brass machine screws. Example photos illustrating example details are shown below.



2. Provide the following features:

    a) LEDs for indicator lights
    b) Mimic bus panel display:

        1) Primary Bus: Red
        2) Nameplates and mimic bus screw fastened.
        3) Manufacturer nameplate (engraved AL or SS) with Manufacturer Date, ord number, and Ratings. One for each vertical section.
        4) Breaker number: Orange w/white lettering
        5) Circuit Description: Blue w/white lettering
        6) Device: White w/Black lettering. Refer to photo below for example.



2.19 ACCESSORIES (one provided for each free-standing switchgear unless noted otherwise).

A. Fuse-handling tool

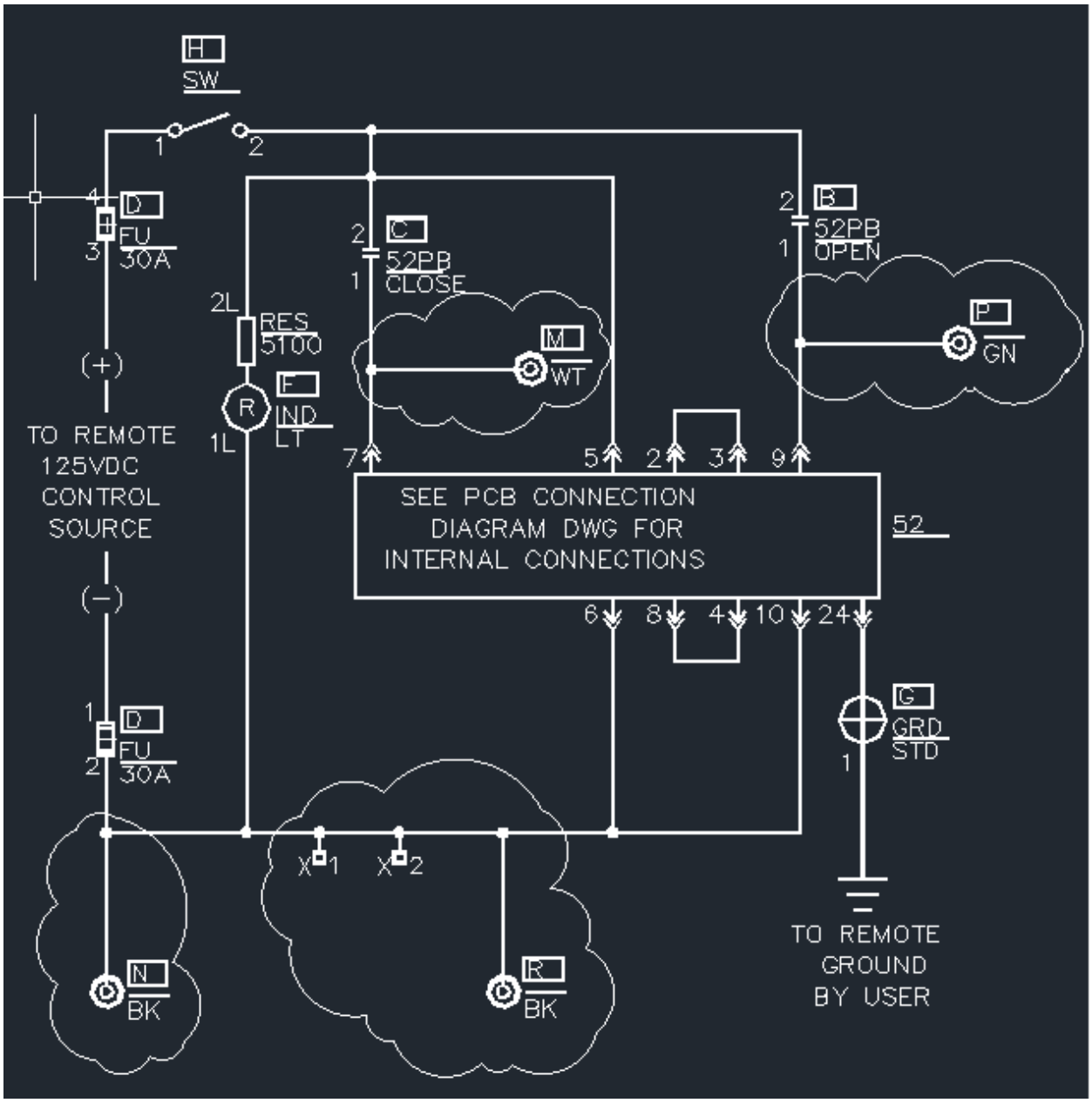
B. Breaker Lifting Truck

C. Breaker Racking Equipment and tools.

D. Remote racking pendant: Qty. = 1 per bus, 2 total.

E. Single Shunt Trip Breaker Test Cell and umbilical cord shipped loose for field installation. Install on wall inside switchgear room. Provide banana jacks for interface with timing unit. See below for example photo:

a. Nameplate
b. Control Circuit Power Indicator Light
c. Close Push Button
d. 8 Foot Cable
e. Test Cabinet Control Power Selector Switch
f. Open Push Button
g. Secondary Disconnect Plug



2.20 EXTRA MATERIALS (per switchgear lineup)

A. Touch up paint: Provide 2 quarts of each color used.

B. Spare fuses: 10% of each style and rating installed.

C. Spare Indicating lights: Provide 2 of each color installed.

D. Spare Lockout Relays: Provide 1 of each Cat #.

E. Terminal Blocks: Provide 2 of each size and style installed.

F. Test Switches: Provide 2 of each style installed.

2.21 QUALITY CONTROL

A. Factory Test: Each switchgear shall be completely assembled, wired, and functionally tested at the factory (as integrated switchgear sections with simulated inputs, as appropriate) in accordance with NETA ATS, latest edition, ANSI/IEEE C37.09, ANSI/IEEE C37.20.2, NEMA C37.55, and NFPA 70B. The factory tests shall include, but shall not be limited to, the following:

1. Design Tests: The manufacturer shall certify that representative breakers of basically the same design, the same interrupter, the same contact speed, and similar dielectric strength have been tested for design adequacy in accordance with ANSI/IEEE C37.09.
2. Production Tests: Production tests shall be made and shall include the following as appropriate for the type of equipment concerned:

    a) Medium Voltage Power Circuit Breaker:

        1) Calibration.
        2) Control and secondary wiring and device check tests.
        3) Dielectric withstand tests.
        4) No load operating tests.
        5) Mechanical test.

    b) Switchgear Lineup (in accordance with ANSI/IEEE C37.20.2):

        1) Dielectric tests.
        2) Mechanical operation tests.
        3) Grounding of instrument transformer cases tests.
        4) Electrical operation and control wiring tests.

3. Functional Tests: The intent of functional tests is to prove the proper interactions of sensors, instruments, protective devices, communications equipment, and control system so as to ensure total system operating capability. Local, remote, and interlocking control modes shall be tested. The manufacturer shall provide devices necessary to simulate such control for test purposes. Device operation, control and interlock operation, protective operations, and alarm and status system activation shall be tested and verified. All protective relays undergo acceptance testing, commissioning and primary and secondary current injection testing.
4. Witness: Manufacturer shall allow for three (3) representatives of the Owner to witness testing of the equipment.

B. Provide a competent factory trained engineer/technician by the manufacturer that is available for service on a 24 hour call basis for duration of warranty period.

PART 3 - EXECUTION

3.1 CONTRACTOR RECEIPT AND EXAMINATION

A. Equipment shall not be removed from the truck upon arrival until both the Contractor and the University Engineer responsible for the project are present to witness removal of equipment to the storage site or jobsite.

B. The Contractor shall inspect the assembly prior to unloading and notify Manufacturer of deficiencies and provide a log of all deficiencies and the resolutions to engineer and owner.

C. Photos shall be taken if any damage is found. Inspect “tip-n-tell” indictors or gravity meters, whichever has been provided. The Contractor/University Engineer shall be responsible for a timely resolution of any damages with the switchgear manufacturer.

D. Contractor shall provide personnel and tools to support and assist with completion of tasks identified in section: FIELD INSTALLATION SUPPORT BY MANUFACTURER’S REPRESENTATIVE.

3.2 FIELD SUPPORT BY MANUFACTURER’S REPRESENTATIVE

A. Prior to Contractor installing, Manufacturer’s field representative shall inspect the installation site and report any deficiencies in writing to Owner’s Representative and Engineer.

B. Manufacturer’s field representative(s) shall inspect the area and assist with lifting and installation of the switchgear only after unsatisfactory conditions have been corrected or accommodated as previously noted.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchgear units and components.

D. Provide plugs for any enclosure openings created by removal of temporary lifting eyes, channels, etc.

E. Remove all packing and shipping materials.

F. Remove crating and place breakers in proper cubicles.

G. Tighten and torque bus joints, electrical connectors, and terminals according to manufacturer's published torque-tightening values.

H. Verify that ground connections are in place.

3.3 IDENTIFICATION

A. Provide warning signs as specified by OSHA and Industry Standards.

B. See Section 2.15 in ths specification for additional identification requirements.

3.4 RELAY PROGRAMMING

A. UEM will provide relay setpoint and coordination data.

B. Contractor shall be responsible for:

1. Implementing the settings (provide relay programming/settings files) in accordance with the information provided as well as relay control and protection logic.
2. Inputting or programming all devices accordingly.

3.5 TESTING AT THE JOBSITE

A. A third-party testing agency who is a NETA certified company, shall be hired by the Contractor as long as they are approved by the University Engineer. Testing shall be completed within a year after equipment has been shipped but before commissioning. Tests as recommended by the NETA Acceptance Testing Publication NETA-ATS (most current version) shall be the requirement for testing of all electrical apparatus (switchgear, circuit breakers, vacuum breakers, relays, and meters, potential transformers, and current transformers). All data shall be recorded on professional and typewritten, legible test sheets (fill in the blank), All tests shall be reviewed by the testing agency and copies of all completed test sheets provided for review by EOR and owner. Any equipment failed by this testing shall be brought to the University Engineer's attention and forwarded to the factory for timely resolution to the problem.

3.6 DATA SHEETS

A. If values submitted by manufacturer are estimated, Data Sheets shall be updated and resubmitted after values are known.

B. Single set of data sheets for multiple switchgear with exact same characteristics may be used as long as tag numbers contained on sheets are clearly identifiable.

C. Data Sheets may require information that will not be known until engineering is complete. Data shall be estimated based on good engineering judgment for similar projects completed, and so indicated on the data sheets indicating "est." next to data.

D. Do not leave items blank or labeled "To Be Determined", or "Later".

E. Do not submit manufacturer product data sheets in place of Data Sheets.

3.7 EQUIPMENT START UP

A. Provide training at the jobsite of customer's personnel by a factory trained field service engineer with at least 10 years experience doing similar training. Provide video recording of

training on USB thumb drive. All training materials are to be supplied by the factory. Provide training topics and schedule in advance for approval by owner.

a) Certified Test Reports from the factory shall be included with the operation and maintenance manuals. Five (5) hard copies are required including one set provided inside the switchgear shipment. A copy of all documentation in PDF format shall be provided on a USB in each manual.

END OF SECTION 261326