THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

# Chilled Water Infrastructure Expansion North Chiller Plant

**SCO ID 22-25588-02F, Code: 42123-355 / 42323-305**
**UNC Bldg. No. 227**

## Prepurchased Electrical Equipment Medium Voltage Switchgear Bid Set

**Submitted by:**

Affiliated Engineers

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AEI Project No. 23480-01

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**MEDIUM-VOLTAGE VACUUM INTERRUPTER SWITCHGEAR**

## PART 1 - GENERAL

1.1 OWNER PRE-PURCHASED EQUIPMENT

A. This equipment will be pre-purchased by the Owner and assigned to the successful Contractor after award expediting delivery and installation.

B. Owner will make available shop drawings of Owner pre-purchased equipment for review. Contractor shall review shop drawings to ascertain that Contractor has included necessary labor and materials to install equipment and complete system it serves.

C. Contractor shall be responsible for arranging/coordinating delivery of equipment and all other activities as if the Contractor purchased the equipment directly. This includes directing the delivery truck to the jobsite, coordinating the date and time of delivery, receipt/unloading of the equipment at the jobsite.

D. Contractor shall install equipment and all auxiliaries as though Contractor had purchased equipment. This shall include, but not be limited to; rigging and setting equipment in place, making connections, starting, testing and installing equipment in accordance with manufacturer's recommendations, and maintaining equipment until such time as project is accepted by Owner. Perform all work and provide materials and connections for Owner furnished equipment in accordance with drawings and scope of work under all related specifications.

E. After completion of equipment installation, assemble equipment shop drawings, operating/maintenance instructions and part lists into the Contractor's project operation/maintenance manuals.

F. The following summarizes the general responsibilities of the electrical equipment supplier:

1. Provide shop drawings and submittal data.
2. Manufacture and delivery of equipment including coordination of exact delivery date and supervision of rigging, unloading and setting.
3. Lead equipment check-out, testing and start-up process.
4. Provide Owner training.
5. Provide O&M documentation.

1.2 SCHEDULE

A. Schedule:

1. The following schedule is anticipated relative to the pre-purchased equipment delivery, installation and activation. This is a preliminary schedule and exact dates are to be coordinated with the Owner and Contractor.

a. Equipment Delivery: November 2026

b. Installation, Start-Up & Commissioning: November 2026 – February 2027

B. Manufacturer shall be able to produce, test and deliver the equipment (FOB) to a location dictated by the Contractor per the schedule described above.

1.3 DESCRIPTION

A. The switchgear lineup shall be free-standing, dead-front type, metal-clad medium-voltage distribution switchgear. The switchgear shall be Arc-Resistant Type 2B per ANSI/IEEE C37.20.7. The lineup shall contain the necessary number of monitoring, control modules and distribution modules (sections), including optional accessories. The switchgear shall be a NEMA rated cabinet construction, for indoor applications.

B. Arc Resistant Type 2B definition: Arc-resistant accessibility is designated for equipment where isolation is required for the instrument compartment and arcing does not cause holes in the freely accessible front, sides, and rear of the enclosure or in the walls isolating the low-voltage control or instrument compartment(s). Smoke ingress in the compartment under evaluation is acceptable. Partial or total distortion of internal compartment walls, without signs of burning from a direct arc strike (i.e., a hole) or openings in the walls (i.e., torn seams) are acceptable. The application of suffix “B” to accessibility type 2 requirements additionally qualifies the equipment for installation of instrument and control devices on the door or cover of the compartment tested without retesting the switchgear for the condition where the door or cover is present with devices mounted on it.

1. Relay and meter Owner preferred brand alternate: SEL.

a. Acceptable alternate manufacturers: Schneider Electric, ABB

2. Refer to the drawings for schematics on relay and communications system architecture for the switchgear system(s).

3. This section is for new 15kV switchgear “MAIN SWGR #1”.

4. The switchgears shall have monitoring and control integrated into the existing UNC SCADA system cabinet located in the building. Provide all work to connect to that Owner furnished head-end equipment and provide support to the Owner for programming and start-up.

C. Provide associated VDC battery system per Section 26 1319.1.

D. Equipment shall be located within a walk-in equipment enclosure per Section 26 2412. New switchgear lineup and enclosure shall be aligned exactly with existing conduit stub-ups.

E. Provide programming of all relays and meter mounted within switchgear. Program devices to coordinate with instrumentation and I/O. Designer shall provide protective function settings and output logic for close permissive and trip signals to Switchgear manufacturer for inclusion in programming of relays. Upon acceptance of relay file configuration and testing, relay files shall be further augmented by relay manufacturer, contracted separately by Owner, to program relays for use in automation and integration into the campus SCADA.

F. This equipment shall be fully commissioned per the requirements in the North Carolina State Construction Office 2020 Electrical Guidelines and Policies Section 260800 and per ANSI/NETA ECS-2015. The Owner will contract directly with the commissioning agent separate from the General Contractor. Equipment supplier shall provide commissioning assistance during shop drawing submittal reviews, equipment inspections, equipment start-up and commissioning. Equipment supplier shall assist with coordinating the scheduling of commissioning activities as directed by the commissioning agent.

1.4 REFERENCE STANDARDS

A. ANSI/IEEE C37.20.2

B. ANSI/IEEE C37.20.7

C. NEMA C37.57

D. ANSI/IEEE C62.11

E. NEMA SG5

F. NEMA SG6

1.5 BID SUBMITTALS

A. Submit all equipment procurement documents, including shop drawings and technical specifications to the State Construction Office for review and approval, in addition to the engineer of record.

B. Cover letter with compliance table listing each specification section and indicating compliance “C”, deviation for alternate “D”, or exception with explanation “E”. Any deviation or exception shall be accompanied with detailed explanation of how design intent is being upheld.

C. Complete Bill of Materials

D. Product Data: for switchgear, major components, relay/meter components, and options/accessories indicated:

E. General Shop Drawings:
   1. For switchgear specified in this Section:
      a. One Line Diagrams for both power and instrumentation & controls.
      b. General Arrangement:

1) Indicate front, plan, and side views of switchgear; overall dimensions and components list; shipping splits and weights.
2) Front elevation indicating location of devices and instruments.
3) Sections through switchgear showing space available for conduits.
4) Indicate conduit windows for new switchgear lineup as well as existing conduit stub-ups.

c. Conduit entrance locations and requirements
d. Configuration, size and number of bus bars for each phase and current rating of buses
e. Ground bus.
f. Short circuit and withstand ratings of switchgear and overcurrent protective devices.
g. Instrument details.
h. Arc Flash ducting system.

F. System Mechanical Drawings:
1. Dimensional plans and elevations, with front view, side views and other pertinent elevation views.
2. Conduit entrance locations and dimensions within all assemblies for both bottom and top entrance.
3. Door details.
4. Circuit breaker ratings.
5. Weight of equipment.
6. Assembly ratings including:
a. Short circuit rating
b. Voltage
c. Continuous current
7. Cable terminal sizes.
8. Base plan showing dimensions of base with anchoring provisions.

1.6 FABRICATION SUBMITTALS

A. All information from the Bid Submittal per Section 1.4 to include any updates to the development of any of the information.

B. Product Data: for switchgear, components and accessories indicated:
1. Include data on features and components and complete description; submit catalog cut sheets with selected features highlighted.
2. Complete wiring diagrams.

C. General Shop Drawings:
1. For switchgear specified in this Section:
a. General Arrangement:
1) Indicate front, plan, and side views of switchgear; overall dimensions and components list; shipping splits and weights.

2) Front elevation indicating location of devices and instruments.
3) Sections through switchgear showing space available for conduits.

b. Conduit entrance locations and requirements including existing conduit stub-ups.
c. Nameplate legends
d. Configuration, size and number of bus bars for each phase and current rating of buses
e. Ground bus.
f. Short circuit and withstand ratings of switchgear and overcurrent protective devices.
g. Instrument details; enclosure types and details
h. Wiring diagrams: power, signal and control wiring
i. Mimic-bus diagram; samples: representative portion of mimic bus with specified finish, for color selection.

D. System Mechanical Drawings:
1. Dimensional plans and elevations, with front view, side views and other pertinent elevation views.
2. Conduit entrance locations and dimensions within all assemblies for both bottom and top entrance.
3. Door details.
4. Circuit breaker ratings.
5. Weight of equipment.
6. Assembly ratings including:
a. Short circuit rating
b. Voltage
c. Continuous current
7. Cable terminal sizes.
8. Base plan showing dimensions of base with anchoring provisions.

E. System Electrical Drawings:
1. Typical AC Three-Line Schematic diagrams with all components cross referenced.
2. Typical DC Schematic diagrams with all components cross referenced.
3. Typical equipment interconnect drawings showing terminal points and external device function.
4. Metering/monitoring and LV wiring scheme.

F. Manufacturer's Installation Instructions:

G. Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

H. Test Reports: Indicate field test and inspection procedures and interpret test results and corrective action taken for compliance with specification requirements.

I. Closeout Submittals:
   1. Project Record Documents:
      a. Record actual locations, configurations, and ratings of switchgear and major components on single-line diagrams and plan layouts. Provide exact circuit breaker models and associated trip units.
   2. Operation and Maintenance Data:
      a. Include manufacturer's recommended operating instructions, maintenance procedures and intervals, and preventive maintenance instructions.
      b. Include manufacturer's written instructions for testing and adjusting overcurrent protective devices.
      c. Include spare parts data listing, source, and current prices of replacement parts and supplies.

1.7 QUALITY ASSURANCE

A. Obtain switchgear from one source and by single manufacturer.

B. Regulatory Requirements:
   1. Comply with NFPA 70 for components and installation.
   2. Furnish products listed and classified by a third party agency amongst those acceptable to the NCBCC (North Carolina Building Code Council) to Label Electrical & Mechanical Equipment.

C. Factory Witness Test
   1. Provide separately priced quote for factory witness test to include four representatives from the Owner, two representatives from Designer (six persons total). The quote shall include all costs for travel, lodging, meals, etc. for the duration of the trip. The testing time and date(s) shall be scheduled at least 21 days prior the test. Provide test script plan for the factory witness test for approval at least 14 days prior to the test. The test script plan shall include all required testing per this specification in addition to standard manufacturer testing.
   2. The factory test (regardless if separately priced quote for witness test is accepted) shall include the following:
      a. Inspection and comprehensive check of all circuit breakers, fuses, protective relays, instrument transformers, metering, etc.
      b. Testing of switchgear and its components per NETA.
      c. Testing of all metering/monitoring and local LCD display.
      d. Testing of all local alarms.
         1) Additional test procedures as directed by the Designer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store in clean, dry space. Maintain factory wrapping or provide additional canvas or plastic cover to protect units from dirt, fumes, water, corrosive substances, construction debris, and traffic. Provide temporary heaters in switchgear as required to prevent condensation.

B. Deliver switchgear in 48" maximum width shipping splits that can be moved in delivery path, individually wrapped for protection, and mounted on shipping skids. Mark crates, boxes, and cartons clearly to identify equipment. Show crate, box, or carton identification number on shipping invoices. Coordinate with manufacturer of electrical walk-in enclosure (Specification 26 2412) to deliver switchgear to electrical walk-in enclosure manufacturing facility such that switchgear can be installed within walk-in enclosure. Switchgear shall be shipped within the walk-in enclosure to the construction site.

C. Handle switchgear in accordance with applicable portions of ANSI/NECA 400. Use factory-installed lifting provisions. Handle carefully to avoid damage to switchgear internal components, enclosure, and finish.

1.9 WARRANTY

A. Manufacturer shall provide two year warranty against defects in materials and workmanship for products specified in this Section. Warranty period shall begin on date of final acceptance.

B. Switchgear manufacturer shall have an established network of factory owned and operated service centers within the continental US capable of servicing the specified equipment.

C. The manufacturer's personnel shall be factory trained and certified in the maintenance and repair of the specified equipment.

D. After-warranty service contracts shall be available to the owner by the manufacturer to provide periodic maintenance and/or repair of the specified equipment

1.10 MAINTENANCE

A. Extra Materials: Furnish extra materials described below that match product installed, are packaged with protective covering for storage, and are identified with labels describing contents.
   1. Potential Transformer Fuses: Equal to 10% of amount installed for each size and type, minimum of two of each size and type.
   2. Control-Power Fuses: Equal to 10% of amount installed for each size and type, minimum of two of each size and type.
   3. Indicating Lights: Furnish 6 of each type required. Equal to 10% of amount installed for each size and type, but no fewer than two of each size and type.

## PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Powell – PowlVac-AR

B. Acceptable Alternates: ABB SafeGear, Point 8 Power

2.2 RATINGS

A. Nominal System Voltage: 12470V 3-phase, 3 wire, grounded, 60 Hz.

B. Rated maximum Voltage: 15 kV

C. Basic Impulse Level: 95 kV.

D. Main Bus Ampacity: as shown on the drawings, continuous.

E. Short Circuit Current Rating: 25 kA, rms sym

F. Vacuum Circuit Breaker:
   1. At Rated Maximum kV - Closing and Latching Capability: 67 kA Crest
   2. Three Second Rating: 25 kA
   3. Rated Interrupting Time: 3 cycles

G. Bus shall be silver plated copper.

H. Bus shall have epoxy flame-retardant and track-resistant insulation

I. Provide a copper ground bus.

2.3 CONSTRUCTION

A. Switchgear Arc-Resistant Assembly – Basic Type 2B Construction:
   1. Metal-clad construction using welded, industrial revited.
   2. Self-supporting, mounted within walk-in enclosure by walk-in enclosure manufacturer.
   3. Front Compartment Doors:
      a. Each compartment housing a high voltage device shall be provided with steel hinged doors.
      b. Door shall be provided with means to padlock
      c. Door shall be provided with a viewing window in view of circuit breaker position.
      d. Door shall withstand arc fault.
      e. Door shall be provided with handle to operate all required latching.
      f. Door shall be provided with safety interlocks to prevent racking breaker into a compartment with door in open position and to prevent opening of door unless breaker is in the disconnected position. There shall be manual interlock override for maintenance purposes. Interlock shall be automatically reset when door is in closed position.

g. The breaker shall be able to be disconnected and racked out with the door in the closed position.

4. Rear Compartment Doors:
   a. Do not provide rear compartment doors on switchgear lineup. Switchgear shall be installed in electrical walk-in enclosure (Section 26 2412) with exterior doors aligned with switchgear sections.
5. Plenum:
   a. Provide plenum over the entire length of the assembly to direct arc fault pressure wave, gases, etc out the top of each section, through the plenum and out the rear wall of the walk-in enclosure.
   b. Plenum shall be constructed of heavy gauge steel.
6. Provide mimic bus. Continuously integrated mimic bus factory applied to front of switchgear. Arrange in single-line diagram format showing bussing, connections and devices, using symbols and letter designations consistent with final mimic-bus diagram. Use black color plastic strips, fastened flat against panel face with corrosion-resistant screws and rivets. Coordinate mimic-bus segments with devices in switchgear sections to which they are applied. Produce concise visual presentation of principal switchgear components and connections.
7. The assembly (including the bussing) shall be capable of future extension from either end for additional cabinets installed to maintain the integrity of the arc-resistant construction.
8. Any cooling or ventilation openings or vents shall conform to arc-resistant construction such that contact will not create a hazard to persons of the integrity of the system.

B. Contacts:
1. Provide silver-plated copper stationary primary contacts.
   a. Provide minimum two spare NO/NC contacts.
2. Provide automatic steel shutter cover stationary primary contacts when breaker is in disconnected position or out of cell.
   a. Provide minimum two spare NO/NC contacts.

C. Provide rails to withdraw 15kV circuit breaker.

2.4 BUS

A. Bus Phase:
1. Silver-plated Copper
2. Amperage as shown on the drawings.
3. Have epoxy flame-retardant and track-resistant insulation/
4. Have provisions for future extension.

B. Bus joints to be plated, bolted, and insulated with easily installed boots.

C. Bus supports to be flame-retardant, track-resistant, glass polyester for 15kV class.

D. A copper ground bus, to which the entire metallic enclosure is solidly connected, shall extend through the length of the switchgear. The ground bus shall be accessible in the cable compartment and shall have connection points in each switchgear section.

2.5 WIRING TERMINATIONS

A. Control wiring 600 volt, UL 1015 or SIS. Use solderless compression screw type connectors for terminating all wires. Current transformer circuit terminations shall be ring tongue compression type. Other circuits shall be ring tongue compression type where feasible, otherwise they shall be spade type applied with the proper tooling.

B. Label control wiring with wire markers.

C. Control wires shall be numbered every six (6) inches and visible next to the terminals. Low level signal circuits shall be provided with shielded wire to minimize electromagnetic interference. Shielded wire grounded at one point.

D. Current transformer circuits are connected through shorting terminal blocks.

E. Control wiring routed in enclosed raceway through high-voltage compartments, and isolated per arc-resistant Type 2B requirements.

F. Voltage transformer primary wiring shall be 15kV insulated.

G. Provide small wiring, terminal blocks, and fuse blocks within vertical section.

H. Provide minimum of 10% spare terminal connections.

I. Incoming/Outgoing Medium Voltage Cabling:
   1. A termination bus shall be provided from the circuit breaker or switchgear primary disconnects to a location that allows cable connections to other equipment. Bus connections to cables shall be rigid.
   2. Termination bus arrangement shall allow at least 36 inches for primary cable terminations and stress cones. The self-cooled rating of the termination bus shall be in accordance with ANSI C37.20.2, Table 4 at 45 deg C.
   3. Provide wire termination system such that no additional cable bracing, tying or lashing is required to maintain short circuit withstand rating of assembly.
   4. Equip each cubicle section that contains lugs for incoming and/or outgoing feeders with horizontal cable supports.
   5. The equipment shall be arranged for bottom entrance.
   6. Provide cable lug boots.
   7. Provide compression lugs of size to match cable size and quantity indicated on drawings. This shall be coordinated during the shop drawing review process.

2.6 CIRCUIT BREAKERS

A. Circuit Breakers
   1. Horizontal draw out type.
   2. Electrically operated

a. Provide 125VDC close and capacitor trip control voltages. Note that controls circuit shall be derived from external battery plant.

3. Operate by a motor-charged stored energy spring mechanism.
   a. Charge spring mechanism normally by universal electric motor and by hand mechanism in emergency situations.
   b. Provide primary disconnecting contacts of silver-plated copper.
4. Contain 3 vacuum interrupters separately mounted.
   a. Mount vacuum interrupter on glass polyester supports for 15kV class.
   b. Provide a contact wear gap indicator for vacuum interrupters.
      1) Indicator shall not require tools to indicate available contact life.
      2) Indicator to be visible when breaker is removed from its compartment.
      3) Current transfer from vacuum interrupter moving stem to breaker main conductor to non-sliding design.
   c. Breaker front panel to be removable when breaker is withdrawn.
5. Control switch and red and green indicating lights to indicate breaker contact position.
6. Be secured in housing between and in the operating and test positions.

B. Provide silver-plated secondary contacts that automatically engage in breaker operating position.
   a. Provide minimum two spare NO/NC contacts.

C. Provide interlocks to:
   1. Prevent closing of breaker between operating and test positions
   2. Trip breakers upon insertion or removal from housing
   3. Discharge stored energy mechanisms upon insertion or removal from the housing.

D. Refer to drawings for design intent of breaker control schematics and interaction with protective relays and auxiliary devices.

2.7 SURGE ARRESTERS

A. Provide 3 surge arrestors as indicated on drawings.

B. Distribution Class

C. Surge arresters to be rated at 15 kV nominal, 12.7kV maximum continuous operating voltage (MCOV).

2.8 PROTECTIVE RELAYS

A. Provide quantity, type and rating of protection relays as indicated on drawings.

B. Basis of design devices listed below. Refer to Section 1.3.B.1.a for acceptable alternate manufacturers.

C. Three-Phase Protective Relays - Applicable to Relays identified as Mains, Ties and Feeders on the drawings:
    1. Preferred Brand Alternate: Manufacturer: SEL-351S, Model Number: 0351S7X3D3J54X1 (351S#B6RL).
        a. Acceptable alternate manufacturers: Schneider Electric, ABB
    2. Indoor Open/Close Push Buttons
    3. True RMS sensing of each phase and ground
    4. Solid-state microprocessor-based multi-functional type
    5. ANSI 25 Synchronism Check
    6. ANSI 50/51 Instantaneous over-current and Time over-current
    7. ANSI 50/51G Residual Ground Instantaneous over-current and Time over-current
    8. ANSI 27 Under voltage
    9. ANSI 32 Power Element
    10. ANSI 59 Overvoltage
    11. ANSI 81 Over/Under Frequency
    12. Built-in alphanumeric display:
        a. Individual phase currents
        b. Ground current
        c. Cause of trip
        d. Magnitude and phase of current causing trip
        e. Peak current demand for each phase and ground since last reset
    13. Metering Capabilities:
        a. Current: IA, IB, IC, IG, IN
        b. Voltage: VA, VB, VC, VN, VAB, VBC, VCA
        c. Power: kW, kVAR, kVA
        d. Energy: MWh, MVARh, MVAh
        e. Power Factor
        f. Frequency
    14. Input Contacts wired internally by Switchgear Manufacturer
        a. 52A – Breaker Closed
        b. 52B – Breaker Open
        c. 52H – Breaker Withdrawn
        d. Trip Coil Monitor
        e. 86 Trip Coil Monitor (Mains and Ties Only)
        f. Non-used inputs wired to terminal block.
    15. Output Contacts wired internally by Switchgear Manufacturer
        a. Breaker Close
        b. Breaker Open
        c. Breaker Protective Function Trip
        d. 86 Trip (Mains and Ties Only)

e. Close Circuit Permissive (Mains and Ties Only)
f. Remaining outputs wired to terminal block.

16. Communication Capability:
    a. One (1) Front EIA-232 Serial Port
    b. One (1) Front USB Port
    c. Two (2) Rear EIA-232 Serial Ports
    d. Two (2) Rear 10/100 Base-T Ethernet Ports
    e. One (1) Rear Fiber-Optic MM ST Serial Port
17. Time Synchronization Capability:
    a. Accept demodulated IRIG-B via rear BNC input.

D. Bus Differential Relay
1. Preferred Brand Alternate: Manufacturer: SEL-587Z, Model Number: 0587Z0X625322XX.
2. LCD Display
3. Provide separate set of current transformers at each breaker for high impedance bus differential system.
4. Communication Capability:
    a. One (1) Front EIA-232 Serial Port
    b. One (1) Rear EIA-485 Port with C675 Pinout Module
5. Time Synchronization Capability:
    a. Accept demodulated IRIG-B via pins of EIA-485 Port

## 2.9 AUXILIARY DEVICES

A. Current Transformers (CTs):
1. Furnish ring type current transformers as indicated on the drawings and as needed for an operational system per the design intent.
2. CTs shall be installed such that they can be removed from the front of the switchgear without exposure to power bussing or cable terminations.
3. CTs shall have secondary termination on a shorting terminal block.
4. CTs shall be fully rated for associated voltage class and suitable for connected burden.
5. Minimum rating factor of CT shall be 1.25 at 30 deg C ambient.

B. Voltage Transformers (PTs) and Control Power Transformers (CPTs):
1. Furnish voltage and control power transformers as indicated on the drawings and as needed for an operational system per the design intent.
2. PTs/CPTs shall be installed in drawout assembly easily disconnected from power bussing.
3. PTs shall have voltage rating comparable to metering equipment with appropriate burden equal to twice the initial load.
4. PTs shall have BIL to match the switchgear rating.

5. PTs/CPTs shall have a lineside current limiting fuse. PTs shall have secondary fuse and CPTs shall have secondary circuit breaker.
    a. Ampacity rating of overcurrent protective devices shall be determined by switchgear manufacturer.
6. Shutters shall isolate primary bus stabs when drawers are withdrawn.

C. Furnish test switch/block to facilitate testing of relay without interrupting service and for prohibiting trip out relay as indicated on drawings. Provide type per tag identified on drawings as follows with black cover and screw terminals:
1. Test Switch Designation TS1, as indicated on drawings:
    a. Two (2) Potential and Eight (8) Current Switches.
    b. Preferred Brand Alternate: ABB FT-1 10 POLE SWITCH MODEL # 849A513G01.
2. Test Switch Designation TS2, as indicated on drawings:
    a. Ten (10) Potential Switches
    b. Preferred Brand Alternate: ABB FT-1 10 POLE SWITCH MODEL # 9676A94G01.
3. Provide nameplate designated function of each switch position per test switch.

D. Provide Breaker Control Switch per breaker.
1. Device 01 (on drawings), manually operated, spring return to center device
2. Minimum one deck
3. Refer to drawings for additional internal wiring requirements.

E. Provide separate Lockout Relay located at face of switchgear as indicated on drawings.
1. Device 86 (on drawings), latching relay, manual reset.
2. Quantity of decks as required to meet drawing intent and provide minimum two (2) spare NO and two (2) spare NC contacts.
3. Refer to drawings for additional internal wiring requirements.

F. Provide IRIG-B coaxial distribution and BNC T connectors to relays and meter as indicated on drawings. No more than ten (10) devices shall be arranged for connection to a single IRIG-B output.
1. IRIG-B output shall be from GPS clock provided by others.

G. Furnish one portable, floor-supported, roller-based, elevating carriage arranged for movement of circuit breakers in and out of compartments.

H. Furnish one DC power breaker test station.

I. Furnish one electric racking device. A portable, remote racking device to allow racking of a circuit breaker from distances of 10 to 20 feet.

J. Strip heaters with thermostatic controls for breaker, bus and cable compartments.
1. Power source for strip heaters shall be from AC Panel within Walk-In Equipment Enclosure.

2.10 OWNERS METERS

A. Metering requirements – Refer to the drawings.

B. Basis of design devices listed below. Refer to Section 1.3.B.1.a for acceptable alternate manufacturers.

C. Meters shall be:
   1. Preferred Brand Alternate: Manufacturer: SEL-735, Model Number: 0735LX20944EXXXXXX16201CX (735#0401).
   2. Microprocessor based.
   3. Digital readout
   4. 3-phase for connection to 4-wire systems.
   5. Meter shall display direct readout metered or calculated values of:
      a. Volts (V)
      b. Amps (A)
      c. Apparent Power (VA)
      d. Power Factor (PF)
      e. Reactive Power (VAR)
      f. Amps demand (Ad)
      g. Real Power Demand (kWd)
      h. Frequency (Hz)
      i. Real Power Usage (kWHr)
   6. PQM meters shall incorporate the following additional features:
      a. Total Harmonic Distortion, Amps (THD)
      b. Total Harmonic Distortion, Volts (THD)
      c. Waveform Capture
      d. Trending and forecasting
      e. Alarm Summary
      f. Voltage Flicker metering
      g. Sag/swell metering
      h. Provided with 10-pole test switch (nickel plated with cover), with 4 handles tied to voltage and 6 handles tied to current. Test switches shall comply with ANSI C12.9.
      i. Provide data outlet adjacent to the meter in switchgear for meter connection to the building network.
   7. Input Contacts wired internally by Switchgear Manufacturer
      a. 52A – Breaker Closed
      b. 52B – Breaker Open
   8. Communication Capability:
      a. One (1) Front EIA-232 Serial Port
      b. One (1) Front USB Port
      c. One (1) Rear EIA-232 Serial Port

d. One (1) Rear EIA-485 Serial Port
e. One (1) Rear 10/100 Base-T Ethernet Port

9. Time Synchronization Capability:
   a. Accept demodulated IRIG-B via 2-pin Phoenix connector.

## 2.11 CONTROL/COMMUNICATION EQUIPMENT

A. Basis of design devices listed below. Refer to Section 1.3.B.1.a for acceptable alternate manufacturers.

B. Provide cubicle within switchgear for control/communication equipment. Provide internal wiring between equipment as indicated on drawings. Control/communication equipment shall be programmed by relay manufacturer, contracted separately by Owner.
   1. Final model numbers shall be coordinated with relay manufacturer/Owner prior to approval of shop drawings.
   2. Basis of design for each device listed below. Refer to section 1.3.B.1.a for list of acceptable alternate manufacturers.

C. Automation Controller
   1. Preferred Brand Alternate: SEL-3350 (Final Model configuration by relay manufacturer).
   2. Horizontal 3U Panel mount
   3. Power supply compatible with 125VDC
   4. RTAC Operating System
   5. Minimum 64GB Industrial Grade SSD
   6. Digital IO Expansion Board; 8 Outputs, 24 Inputs
      a. Input Contacts wired internally by Equipment Enclosure Manufacturer
         1) Enclosure Smoke Detector Alarm
         2) Enclosure Temp Sensor, High Temp Alarm
         3) Enclosure HVAC Unit #1 Alarm
         4) Enclosure HVAC Unit #2 Alarm
         5) Enclosure H2 Detector Alarm

D. Satellite-Synchronized Clock
   1. Preferred Brand Alternate: SEL-2488 model # 24880PAX1181AX23X (2488#7X23)
   2. Panel mount
   3. Power supply compatible with 125VDC
   4. Antenna and Complete Installation Kit, basis of design:
      a. SEL-9524A GPS Antenna (installed by Equipment Enclosure Manufacturer)
      b. Antenna Pipe-Mounting Kit (PN: 915900043) (installed by Equipment Enclosure Manufacturer)
      c. 25 ft SEL-C961 LMR-400 Cable (installed by Equipment Enclosure Manufacturer)

d. Gas Tube Coaxial Surge Protector and Mounting Kit (PN: 915900139)
e. SEL-C961 LMR-400 Cable

5. Provide IRIG-B distribution to devices internal to switchgear as indicated on drawings.

E. Managed 24-Port Ethernet Switch

1. Preferred Brand Alternate: SEL-2730M model # 2730M0APAX1111CCCCX0 (2730M#C449)
2. Quantity as indicated on drawings.
3. Four SFP Cages (Ports 1-4)
4. Four Copper 10/100/1000 Mbps (Ports 5-8)
5. Sixteen 10/100 Mbps (Ports 9-24)
6. Panel mount
7. Power supply compatible with 125VDC
8. Provide ethernet distribution to devices internal to switchgear as indicated on drawings.

2.12 NAMEPLATE

A. Nameplates

1. Engraved with 3/16” high black lettering on laminated plastic white background
2. Secured to switchgear enclosure with screws

B. Switchgear assembly:

1. Provide nameplate indicating:
   a. Manufacturer's name and drawing number
      1) Voltage ratings (kV nominal; kV maximum design; kV BIL)
      2) Main bus continuous rating (A)
      3) Short circuit ratings (amperes, rms symmetrical and MVA 3-phase symmetrical at rated nominal voltage)
      4) Monetary and fault-closing ratings (amperes, rms asymmetrical)
   b. Each bay shall bear nameplate indicating:
      1) Ratings of interrupter switch (amperes continuous and interrupting)
      2) Maximum rating of power fuse in amperes
      3) Catalog number of fuse units or refill units
   c. Mark control components for identification corresponding to designation on manufacturer’s drawings.

## PART 3 - EXECUTION - BY EQUIPMENT MANUFACTURER

3.1 FIELD QUALITY CONTROL

A. Manufacturer’s Field Service

1. Engage a factory-authorized service representative to inspect and adjust field assembled components and equipment installation, including connections.

2. Provide startup services for switchgear to provide a fully operational system. Startup services shall include but not be limited to:
    a. Inspection and comprehensive check of all circuit breakers, fuses, protective relays, instrument transformers, metering, etc.
    b. Verify functionality of internal and external control wiring associated with equipment.
3. Prior to energization, factory representative shall visually inspect switchgear installation to ensure that all switches, motor operators and breaker chargers are operable, all breaker compartments rack-in/out and bus connections are complete.
4. Switch operators shall be tested once after energization.
5. Measure primary and secondary voltages and make appropriate tap adjustments.

B. Provide copy of manufacturer's representative's certification

C. Inspect equipment for physical damage, proper alignment, connections, anchorage, seismic restraints and grounding.

3.2 SOFTWARE INSTALLATION

A. Switchgear Manufacturer shall upload program files for each protective relay and meter within the switchgear.

B. Upload or modification of each file in the field shall follow the following procedure:
1. Download the currently installed file and save a copy labeled with the name of the relay and a suffix indicating “AS FOUND ON” with date.
2. Upload the modified file in the field.
3. Download the modified file and save a copy labeled with the name of the relay and a suffix indicating “AS LEFT ON” with date.
4. Use software to perform a comparison of the “AS FOUND” and “AS LEFT” file.
5. Alert engineer/owner to any differences discovered from the comparison that are not known changes.

C. Upon acceptance of program file configuration and testing, program files shall be further augmented by relay manufacturer, contracted separately by Owner, to program relays for use in automation and integration into the campus SCADA.

3.3 TRAINING

A. Provide services of factory-trained representative to instruct Owner on maintenance and operation for two (2) sessions, with each session a period of 4 hours.

## PART 4 - EXECUTION - BY INSTALLING CONTRACTOR

4.1 COORDINATION

A. Coordinate with miscellaneous trades for equipment foreign to the electrical installation to be outside of dedicated electrical space.

B. Verify with manufacturer that “touch-up” paint kit is available for repainting.

4.2 EXAMINATION

A. Examine areas and surface to receive switchboards for compliance with requirements, installation tolerances, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Verify that space indicated for switchgear mounting meets code-required working clearances.

C. Notify Designer of any discrepancies prior to submittal of product data and shop drawings.

4.3 INSTALLATION

A. Install equipment per manufacturer's recommendations and as indicated.

B. Install engraved plastic nameplates under provisions of Section 26 0553 – Electrical Systems Identification for each switchgear, every instrument, overcurrent protective device and disconnect device. Attach nameplate to exterior of each switchgear using small corrosion-resistant metal screws and rivets. Do not use contact adhesive.

C. Install switchgears in dedicated electrical space per NFPA 70, and as indicated on drawings.

D. Tighten electrical connectors and terminal according to equipment manufacturer’s published torque-tightening values. Where manufacturer’s torque values are not indicated, use those specified in UL 486A-486B.

E. Install control/communication wiring between Switchgear and SCADA racks.

4.4 CONNECTIONS

A. Ground switchgear according to Section 26 0526 – Grounding and Bonding for Electrical Systems.

B. Connect power and control wiring according to Section 26 0519 – Low-Voltage Electrical Power Conductors and Cables.

4.5 FIELD QUALITY CONTROL

A. Inspect switchgear for physical damage, proper alignment, connections, anchorage, seismic restraints and grounding.

B. Test continuity of each circuit.

C. Test switchgear per requirements in Sections 26 0812 – Power Distribution Acceptance Tests and 26 0813 – Power Distribution Acceptance Test Tables.

D. Interpret test results in writing and submit to Engineer.

E. Test switch operators once after energizing.

4.6 REPAINTING

A. Remove paint splatters and other marks from surface of equipment.

B. Touch-up chips, scratches or marred finishes to match original finish, using manufacturer-supplied paint kit. Leave remaining paint with Owner.

4.7 SITE ACCEPTANCE TESTING

A. Provide assistance to test sequence of operations of automation system.

4.8 CLEANING

A. Clean switchgear during construction phase, prior to initial testing and energization of unit, and prior to final punch-list.

B. Cleaning procedures as follows:
   1. Vacuum surfaces of enclosure and low voltage equipment.
   2. Blow out components with dry compressed air.
   3. Use small paintbrush to dust small, hard to reach crevices.

**END OF SECTION**

**SECTION 26 1319.1**

**DC BATTERY SYSTEM**

## PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide a complete DC Battery System, including battery rack, spill containment, battery chargers and fused disconnect.

B. DC Battery system shall be provided by the switchgear manufacturer. Refer to specification 26 1319 Medium-Voltage Vacuum Interrupter Switchgear.

1.2 SUBMITTALS

A. Submit all equipment procurement documents, including shop drawings and technical specifications, to the State Construction Office for review and approval, in addition to the engineer of record.

B. Compliance Package: Submit document package confirming specifications and design intent have been met. Note that the compliance package shall include information for the switchgear system as well as all components of the battery and controls system. Compliance package shall include, but shall not be limited to, the following:

1. Cover letter with compliance table listing each specification section and indicating compliance “C”, deviation for alternate “D”, or exception with explanation “E”. Any deviation or exception shall be accompanied with detailed explanation of how design intent is being upheld.
2. Complete bill of materials
3. Engineering drawings for each component on the bill of materials. Drawings shall indicate physical dimensions of equipment.
4. Battery System sizing calculations to align with project specific switchgear components, relays, control equipment, etc. based on parameters defined in this specification and drawings.
5. Battery Charger sizing calculations to align with battery system sizing calculations based on parameters defined in this specification and drawings.
6. Single line diagram including actual configurations of components
7. Product catalog sheets or equipment brochures.
8. Product guide specifications.

C. Product Data: Submit product data showing all material proposed for the system. Submit sufficient information to determine compliance with the Drawings and Specifications. Product data shall include, but shall not be limited to, the following:

1. As bid system bill of materials.
2. Product catalog sheets or equipment brochures.

D. Manufacturer's Installation Instructions:

1. Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

E. Recommended spare parts lists.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Comply with NFPA 70 for components and installation.
   2. Furnish products listed and classified by a third party agency amongst those acceptable to the NCBCC (North Carolina Building Code Council) to Label Electrical & Mechanical Equipment

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store in clean, dry space. Maintain factory wrapping or provide additional canvas or plastic cover to protect units from dirt, fumes, water, corrosive substances, construction debris, and traffic.

B. Use factory-installed lifting provisions. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

1.5 WARRANTY

A. Manufacturer shall provide standard two year warranty against defects in materials and workmanship for products specified in this Section. Warranty period shall begin on date of final acceptance.

## PART 2 - PRODUCTS

2.1 125VDC BATTERY

A. Acceptable Manufacturers: C&D, East Penn, Enersys, Exide, approved equal by switchgear supplier

B. Battery shall be Valve Regulated Lead Acid type.
   1. Battery system shall be sized based on the following criteria per the project specific vacuum breakers, relay, and auxiliary power requirements of each switchgear and associated control equipment.
      a. Ambient Temperature = 77 deg F
      b. End of Life Cell Voltage = 1.75V
      c. Aging Compensation Factor = 1.25
      d. Design Factor = 1.1
      e. 20-year design life
      f. Individual battery jar weight shall not exceed 225 lbs.
      g. Battery shall be sized based on the following momentary loads, continuous loads and load profile. Note that the Electrical SCADA equipment are estimated. Final determination of the Electrical SCADA equipment shall be determined by SEL/Owner prior to approval of battery system shop drawings.
         1). Note that total trip is based on the largest bus differential zone (most breakers tripping simultaneously).

| **Momentary Loads** | | | |
|---|---|---|---|
| **Description** | **QTY** | **AMPS** | **TOT** |
| Trip Coil | 8 | 0.7 | 5.6 |
| Close Coil | 3 | 1.8 | 5.4 |
| Charging Motor | 1 | 15 | 15 |
| | | | |
| Total Trip | | | 5.6 |
| Total Close | | | 5.4 |
| Total Charging | | | 15 |
| | | | |
| **Total Continuous Load** (Includes Future Loads) | | | |
| **Description** | **QTY** | **AMPS** | **TOT** |
| **SWGR Relay & Meter Equipment** | | | |
| Main Relay + Digital Inputs | 2 | 0.21 | 0.4 |
| Tie Relay + Digital Inputs | 1 | 0.21 | 0.2 |
| Feeder Relay + Digital Inputs | 12 | 0.21 | 2.5 |
| Bus Differential Relay + Digital Inputs | 2 | 0.05 | 0.1 |
| METER | 2 | 0.12 | 0.2 |
| LED Pilot Lights | 45 | 0.01 | 0.5 |
| **Electrical SCADA Equipment - Estimated** | | | |
| GPS Clock | 1 | 0.75 | 0.8 |
| Ethernet Switch | 2 | 0.79 | 1.6 |
| PLC | 1 | 3.71 | 3.7 |
| I/O Interface | 1 | 0.42 | 0.4 |
| Misc Buffer | 1 | 1.00 | 1.0 |
| | | | |
| Total Continuous | | | 11.48 |
| | | | |
| **Sizing Parameters** | | | |
| **Step Description** | **Step** | **Duration** | **AMPS** |
| Total Continuous | 1 | 4 hr | 11.48 |
| Total Continuous + Total Trip | 2 | 1 min | 17.08 |
| Total Continuous + Total Charge | 3 | 1 min | 26.48 |
| | | | |

2. Battery rack shall be arranged to not exceed 4’-0” L x 2’-0” D. Height shall be as necessary for quantity of jars:
   a. Seismic Zone 2L rated
   b. Provide front safety shield extending the full height of the battery rack.
3. Provide UL Listed spill containment with minimum 4” High Steel Barrier with liner and neutralization and absorption pillows listed and classified by a third party agency amongst those acceptable to the NCBCC (North Carolina Building Code Council to Label Electrical & Mechanical Equipment..

2.2 125VDC BATTERY CHARGER

A. Provide two (2) battery chargers arranged for parallel operation for redundancy.

B. Acceptable Manufacturers: SAFT, Hindle or Approved Equal by switchgear supplier.

C. Input: 240, 1 phase AC Voltage

D. Output: 125V DC

E. Microprocessor controlled with SCR based rectification.

F. AC Input and DC Output Circuit Breakers

G. Size Battery Charger based on calculated amp-hours removed from battery system per the following:
   1. Minimum Charger Size = (Amp-Hour Removed x Recharge Factor) / Recharge Time + Total Continuous Load
   2. Recharge Factor = 1.1
   3. Recharge Time = 8 Hours

H. Provide battery eliminator option.

I. Provide modbus communication card via ethernet for the following parameters at a minimum:
   1. AC Input Failure
   2. Summary Alarm
   3. DC Output Voltage
   4. DC Output Current

J. Nema 1 Enclosure

K. Maximum Dimensions: 1’-8” L x 1’-8” D

2.3 DC FUSED DISCONNECT

1. Acceptable Manufacturer: ABB/GE, Eaton, Square D
2. NEMA AB 1, UL 98.
3. 125VDC.
4. Ampere Rating: As Determined by Switchgear Manufacturer
5. Load interrupter enclosed knife switch, heavy-duty type
6. Non-fusible type as indicated.
7. Switch Interiors:
   a. Switch blades that are visible in "OFF" position when switch door is open
   b. Plated current carrying parts.
8. Switch Mechanism:
   a. Quick-make, quick-break, with visible blades and externally operable handle
   b. Lockable only in "OFF" position and accept three industrial type, heavy-duty padlocks
   c. Dual cover interlock to prevent unauthorized opening of switch door when handle is in "ON" position, and to prevent closing of switch mechanism with door open.
   d. Defeater mechanism to bypass interlock.
   e. Operating handle integral part of enclosure

f. Handle to physically indicate "ON" and "OFF" position.

## PART 3 - EXECUTION – BY EQUIPMENT MANUFACTURER

3.1 MANUFACTURER'S FIELD SERVICE

A. Factory-authorized service representative shall inspect and adjust field assembled components and equipment installation, including connections, prior to energization.

B. Provide startup services to provide a fully operational system. Startup services shall include but not be limited to:
   1. Verify all functional operations.
   2. Verify communications with the SCADA.

C. Provide copy of manufacturer's representative's certification.

3.2 ADJUSTING

A. Set field-adjustable circuit breakers trip settings, to values indicated by Designer.

3.3 FIELD QUALITY CONTROL

A. Inspect equipment for physical damage, proper alignment, connections, anchorage and grounding.

3.4 ACCEPTANCE TESTING

A. Testing by Equipment Supplier. Equipment Supplier shall provide factory standard start-up/check out services.

## PART 4 - EXECUTION - BY INSTALLING CONTRACTOR

4.1 EXAMINATION

A. Visually inspect to confirm that items and accessories are in accordance with specifications and drawings.

B. Verify field measurements are as shown on shop drawings.

C. Verify that required utilities are available, in proper location, and ready for use.

4.2 INSTALLATION

A. Install equipment per manufacturer's recommendations and as indicated.

B. Coordinate final locations of equipment with Owner and review final locations with Owner/Engineer prior to setting equipment.

C. Protect equipment during installation to prevent twisting or deformations, exposure to potentially damaging environments, and work of other trades. Maintain protection until completion of construction.

4.3 CONNECTIONS

A. Ground equipment as indicated on drawings and per Manufacturer's recommendations.

B. Connect power and control wiring.

4.4 REPAINTING

A. Remove paint splatters and other marks from surface of equipment.

B. Touch-up chips, scratches or marred finishes to match original finish, using manufacturer-supplied paint kit. Leave remaining paint with Owner.

4.5 CLEANING

A. Clean equipment during construction phase, prior to initial testing and energization of unit, and prior to final punch-list.

B. Cleaning procedures as follows:
   1. Vacuum surfaces of enclosure and low voltage equipment.
   2. Blow out components with dry compressed air.
   3. Use small paintbrush to dust small, hard to reach crevices.

**END OF SECTION**

**SECTION 26 2412**
**ELECTRICAL WALK-IN EQUIPMENT ENCLOSURE**

## PART 1 - GENERAL

1.1 DESCRIPTION

A. Section includes weatherproof, walk-in enclosure that will house all components of the integrated assembly for the 15KV switchgear system including interior conduits/raceways, flooring system with removable panels to access structural base for cabling and conduits, roofing system, and rain gutters to accommodate rain and snow. Design and provide any required exterior metal stair/railing/platform assembly to meet the design intent. Enclosure shall be provided as an integrated assembly. The enclosure shall be completely designed by the power distribution equipment manufacturer. Refer to the drawings for additional details on the enclosure.

1.2 REFERENCE STANDARDS

A. NFPA 70 – National Electrical Code

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum)

1.3 BID SUBMITTALS

A. Cover letter with compliance table listing each specification section and indicating compliance “C”, deviation for alternate “D”, or exception with explanation “E”. Any deviation or exception shall be accompanied with detailed explanation of how design intent is being upheld.
   1. For the enclosure specified in this Section:
      a. Overall dimensions, elevations of enclosure. Front, top, side, isometric views.
      b. Permanent stairs, railings, platforms.
      c. HVAC and ventilation equipment product data sheets.
      d. Dimensions of all internal components as indicated on the drawings.
      e. Clearance requirements interior/exterior to the enclosure.
      f. Total weight of enclosure with components installed.
      g. Location(s) of lights, receptacles, switches, HVAC, etc.

1.4 FABRICATION SUBMITTALS

A. All information from the Bid Submittal per Section 1.4 to include any updates to the development of any of the information.
   1. For the enclosure specified in this Section:
      a. Overall dimensions, elevations of enclosure. Front, top, side, isometric views.
      b. Shop drawings for steel base and frame construction including exact dimensions and conduit windows. Removable floor plates for access into the base for cabling installation and management.
      c. Door details including hardware.

d. Permanent stairs, railings, platforms.
e. HVAC and ventilation equipment product data sheets.
f. Light fixture, exit sign, switches, receptacles, smoke detector, and other aux device product data sheets.
g. Dimensions of all internal components as indicated on the drawings.
h. Clearance requirements interior/exterior to the enclosure.
i. Total weight of enclosure with components installed.
j. Location(s) of lights, receptacles, switches, HVAC, etc.
k. Location(s) of conduit stub-us for power to/from enclosure, and controls cabling.
l. Complete shop drawings indicating construction, dimensions, support structures, etc. of enclosure.
m. Paint color sample for the exterior.

B. Manufacturer's Installation Instructions:
1. Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

C. Test Reports: Indicate field test and inspection procedures and interpret test results and corrective action taken for compliance with specification requirements.

D. Closeout Submittals:
1. Project Record Documents:
a. Record actual locations, configurations, and ratings of equipment and major components on single-line diagrams and plan layouts.
2. Operation and Maintenance Data:
a. Include manufacturer's recommended operating instructions, maintenance procedures and intervals, and preventive maintenance instructions.

## 1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
1. Comply with NFPA 70 for components and installation.
2. Furnish products listed and classified by a third party agency amongst those acceptable to the NCBCC (North Carolina Building Code Council) to Label Electrical & Mechanical Equipment.
3. Provide electrical walk-in enclosure with a third-party inspection agency approval stamp with approver's name on each page of the walk-in enclosure plans. Third party inspection agency must be amongst the current listing of Approved Third Party Certification Agencies for Modular Construction listed within the North Carolina Department of Insurance Modular Construction Directory.
4. Comply with all applicable regulations of states, counties, and cities within the route of transit from the factory of origin to the project site, including, but not limited to, permit fees and approvals related to "oversize" and "overweight" limitations of each applicable jurisdiction.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store in clean, dry space. Maintain factory wrapping or provide additional canvas or plastic cover to protect units from dirt, fumes, water, corrosive substances, construction debris, and traffic. Provide temporary heaters as required to prevent condensation.

B. Coordinate with switchgear manufacturer to receive switchgear lineup and install within electrical walk-in enclosure during enclosure manufacture. Refer to 26 1319. Provide any and all temporary and/or permanent anchoring and supports required to ship switchgear inside of walk-in enclosure to the construction site. After switchgear has been delivered by the switchgear manufacturer to the walk-in enclosure manufacturing site and received and accepted by the walk-in manufacturer, the walk-in enclosure manufacturer shall be responsible for any damage to switchgear during the construction, storage, or shipping of the walk-in enclosure.

1.7 WARRANTY

A. Manufacturer shall provide standard two year warranty against defects in materials and workmanship for products specified in this Section. Warranty period shall begin on date of final acceptance.

## PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Power distribution equipment manufacturer or their chosen 3rd party partner.

2.2 CONSTRUCTION

A. Enclosure: Steel, NEMA 250, Type 3R walk-in:

B. Outdoor Walk-in Enclosure:
   1. Weatherproof, sheltered-aisle construction shall be designed and constructed for outdoor use, under wind and seismic load conditions per the IBC or State guidelines for Chapel Hill, North Carolina.
   2. Dimensions of enclosure shall be coordinated to align with existing conduit stub-ups and proximity to existing retaining wall and building wall as indicated on the drawings and verified during the shop drawing review process.
      a. Provide a minimum of 72” front aisle depth in front of the 15kV Switchgear.
   3. The enclosure and all components mounted thereon shall be designed for, and anchored sufficiently for, transportation to the job site.
   4. The skid shall be of welded construction.
      a. Welded construction shall utilize ASTM-A36 minimum structural steel members, sized and arranged for proper strength, and able to withstand the stress and loads which will result when lifting the complete factory fabricated and equipped assemblies. Welding shall be in accordance with the requirements of AWSD1.1. All welding shall be performed by welders certified for the work being performed. Suppliers shall be prepared to show welders’ certificates.

1) Deflection shall be L/240. The enclosure shall be suitable for installation on a concrete pad.
2) The skid shall be equipped with four (4) stainless steel ground pads located at opposite corners of the skid with provisions for NEMA hole pattern lug.
3) The skid shall be provided with a minimum of 8 mils mastic undercoating.

5. The floor shall be a minimum of 1/4-inch H.R. ASTM-A36 minimum smooth steel plate, welded to the perimeter and longitudinal and/or transverse structural members of the skid. The floor loading shall be no less than 250 PSF.
6. Enclosure walls, roof and ceiling shall be fabricated from G90 galvanized steel. Exterior walls, exterior roof and interior ceiling shall be self-framing, interlocking design, with maximum panel width of 16-inch, or framed construction with maximum panel width of 36-inch.
7. Exterior walls shall be minimum of 18-gauge thickness for self-framing and interlocking design, or 24-gauge thickness framed construction design, but rated to withstand the loading requirements of the job site.
8. Interior walls shall be constructed of six-inch “ribbed” panel construction, bolted to adjoining walls, which is minimum 18- gauge thickness for self-framing and interlocking design, or 22-gauge thickness framed construction design, but rated to withstand the loading requirements of the job site.
9. Exterior roof shall be minimum of 18-gauge thickness for self-framing and interlocking design, or 24-gauge thickness framed construction design, but rated to withstand the loading requirements of the job site. The roof shall be sloped away from the personnel doors, where feasible. Gutters and downspouts shall be provided when the roof slope is directly over personnel or rear access equipment doors.
10. Interior ceiling shall be minimum of 18-gauge thickness for self-framing and interlocking design, or 22-gauge thickness framed construction design, but rated to withstand the loading requirements of the job site
11. For an enclosure which must be shipped in multiple shipping sections, miscellaneous NEMA 1 junction boxes will be provided at the shipping splits for easy breakdown of the enclosure wiring for shipment and reconnection at the job site. Prior to shipment the open end/sides of each shipping section will be crated (weatherproofed) for transit to the job site.
12. Where wall bulkhead penetrations are required, the cutouts shall be completely framed with 1/4” aluminum cover plates with neoprene gasket.
13. All fastening hardware shall be zinc plated, stainless steel or aluminum. Welding of galvanized steel and rivets shall not be the primary method of exterior fastening. Rivets can be used for mounting non-load-bearing trim members.
14. The walls, roof and floor shall be fully insulated, with a minimum of R-11 insulation. The walls and roof shall be provided with fiberglass batt type insulation, minimum R-11. The floor shall be provided with polyurethane spray foam insulation, minimum R-6.
15. The enclosure shall be provided with a paint system per the following:

a. The skid shall be prepared to the appropriate SSPC standard (SSPC-1, SSPC-2, SSPC-3) for removal of rust and scale prior to painting. A 2-3 mil application of Zinc rich primer shall be provided.
b. The floor shall be provided with a 2-3 mil application of “Red” epoxy iron oxide primer, followed by a 2-3 mil application of ANSI-61 gray epoxy, with a non-skid finish.
c. The exterior and interior of the enclosure shall be provided with a 0.3-0.6 mil application of a vinyl wash primer, followed by a 2-3 mil application of white epoxy paint.

16. Doors shall be double wall construction, with brushed aluminum panic hardware with cylinder lock and thumb latch, brushed aluminum automatic closure with built-in hold open device, prime coat or stainless steel hinges, threshold, weather-stripping, drip shields/water flashing, “DANGER, HIGH VOLTAGE, KEEP OUT” sign.
    a. 4’-0” double door at one end.
    b. 3’-0” single door at one end
    c. 7’-0” door heights.
    d. Exterior padlocking of door shall not prevent operation of panic hardware from interior of enclosure.
17. For switchgear rear access, the supplier shall provide 14-guage minimum galvanized steel, gasketed and hinged equipment rear access doors, with 3-point latching system with galvanized pad-lockable handles, “DANGER HIGH VOLTAGE” sign, and drip shields/water flashing. Rear access doors shall be coordinated and aligned with MV switchgear specified in 26 1319.
18. Interior lights:
    a. LED strip fixtures controlled by 3-way timer switch at each entry door.
    b. 90-minute battery backed up exit signs.
    c. 90-minute battery backed up emergency lighting unit to provide illumination
19. Exterior lights:
    a. LED wall-pack within integral photocell and 90-minute battery backup located within enclosure.
    b. Exterior light mounted above each man door.
20. Interior receptacles, minimum of two.
21. Exterior GFCI protected receptacles, a minimum of two.
22. Ventilating exhaust fan and louvers with insect and rodent screen and replaceable fiberglass filters; filters: removable from exterior of enclosure.
    a. Exhaust fan shall have a minimum of 1 cfm/sqft ventilation.
    b. Orientated above battery system.
23. Hydrogen Detector:
    a. Power Supply: 120VAC
    b. Alarm Setpoint: 0.5 LEL
    c. Range: 0-2 times Alarm Setpoint
    d. Alarm Output: NO/NC Contact

1) Alarm to SCADA system via RTAC within Switchgear

24. HVAC:
    a. Provide means to heat and cool the enclosure:
    b. Maximum temperature - 80°F
    c. Minimum temperature - 68°F
    d. HVAC units controlled via programmable, digital thermostat. Provide a separate temperature sensor that shall alarm upon programmable high temp to SCADA system via RTAC within Switchgear.
    e. Provide exterior, wall-hung packaged, refrigerant-based air conditioning unit with electric heating. Single 240V power input from distribution panel within the enclosure. Equipment vendor responsible for final sizing of units. Assume two units are required. Provide summary alarm from each unit to SCADA system via RTAC within Switchgear.
    f. Provide NEMA 3R disconnect switch for each air handler.
25. Power for lights, receptacles, exhaust fan, HVAC, H2 detector and 15kV switchgear strip heaters shall be obtained from AC panelboard inside the enclosure.
    a. AC Panelboard shall be 240/120V.
    b. Fed from control power transformer transfer scheme mounted within 15kV Switchgear.
    c. Ampacity of Panelboard determined by enclosure manufacturer.
26. DC Battery System shall be provided per Specification 26 1319.1 and mounted within Enclosure. Provide DC Panelboard.
    a. DC Panelboard shall be 125VDC.
    b. DC Panelboard shall be fed from DC Battery System and provide DC power to 15kV Switchgear.
    c. Coordinate quantity of DC circuits with 15kV Switchgear Manufacturer.
    d. Ampacity of Panelboard determined by Switchgear Manufacturer.
27. Provide all conduit between devices located within enclosure. Conduit shall be EMT.
28. All wiring shall be type THWN, #12 AWG minimum for power circuits, minimum #14 AWG for control circuits. For all control interconnection wiring, both ends of the wire shall be provided with polyolefin sleeve type wire markers.
29. Grounding Bus: Provide one (1) grounding bar. Predrilled rectangular bar of annealed copper, 1/4 by 2 inches by 24 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart.
    a. Bond ground bar to Enclosure and Enclosure Base
    b. Bond ground bar to AC Panelboard, DC Panelboard and DC Battery System
    c. Bond ground to bar to 15kV Switchgear ground bus.
30. Provide plenum exhaust vents on rear of enclosure to direct arc fault energy from switchgear lineup out of the enclosure. Refer to 26 1319 2.3.A.5.

## PART 3 - EXECUTION - BY EQUIPMENT MANUFACTURER

3.1 MANUFACTURER'S FIELD SERVICE

A. Engage a factory-authorized service representative to inspect and adjust field assembled components and equipment installation, including connections.

1. Prior to energization, factory representative shall visually inspect enclosure and equipment within enclosure installation to ensure that devices are operable and bus connections are complete.
2. Switch operators shall be tested once after energization.
3. Provide copy of manufacturer's representative's certification.

B. Provide the services of factory-trained representative to instruct Owner on maintenance and operation for period of 4 hours.

## PART 4 - EXECUTION - BY INSTALLING CONTRACTOR

4.1 EXAMINATION

A. Examine areas and surface to receive enclosure for compliance with requirements, installation tolerances, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Verify that space indicated for enclosure mounting meets code-required working clearances.

C. Notify Designer of any discrepancies prior to submittal of product data and shop drawings.

4.2 INSTALLATION

A. Install equipment per manufacturer's recommendations and as indicated.

B. Coordinate final locations of equipment with Owner and review final locations with Designer prior to setting equipment.

C. Protect equipment during installation to prevent twisting or deformations, exposure to potentially damaging environments, and work of other trades. Maintain protection until completion of construction.

D. Tighten electrical connectors and terminal according to equipment manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

E. Apply temporary heat to maintain temperature according to manufacturer's written instructions.

4.3 CONNECTIONS

A. Ground enclosure according to Section 26 0526 – Grounding and Bonding for Electrical Systems.

B. Connect power and control wiring according to Section 26 0519 – Low-Voltage Electrical Power Conductors and Cables.

4.4 FIELD QUALITY CONTROL

A. Inspect enclosure and components within enclosure for physical damage, proper alignment, connections, anchorage and grounding.

4.5 REPAINTING

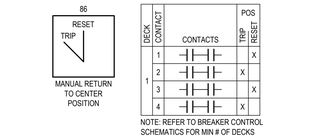
A. Remove paint splatters and other marks from surface of equipment.

B. Touch-up chips, scratches or marred finishes to match original finish, using manufacturer-supplied paint kit. Leave remaining paint with Owner.

4.6 CLEANING

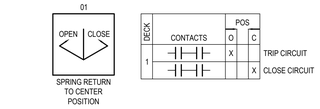
A. Clean enclosure during construction phase, prior to initial testing and energization, and prior to final punch list, after other trades have departed. Cleaning procedures shall be as follows:
   1. Vacuum dirt and construction debris from interior and exterior of equipment; do not use compressed air to assist in cleaning.
   2. Use paintbrush to dust small, hard-to-reach crevices.

**END OF SECTION**



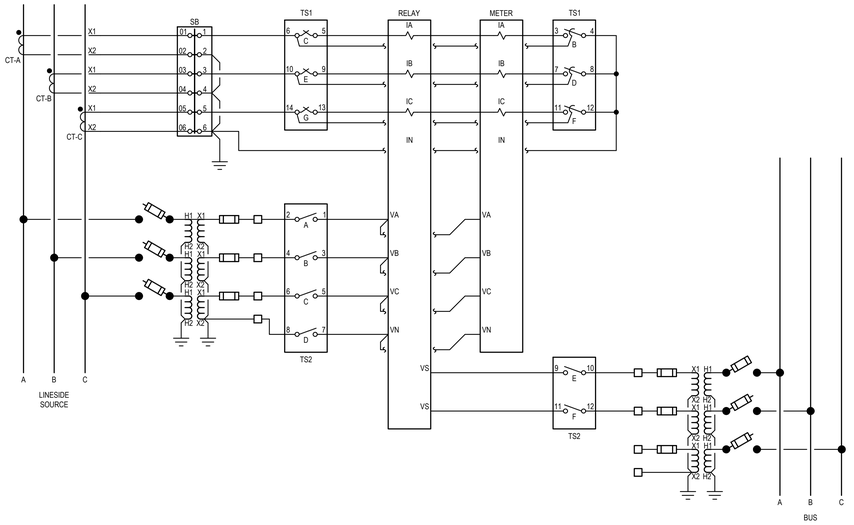

## 6 86 LOCKOUT RELAY DETAIL

SCALE: NOT TO SCALE



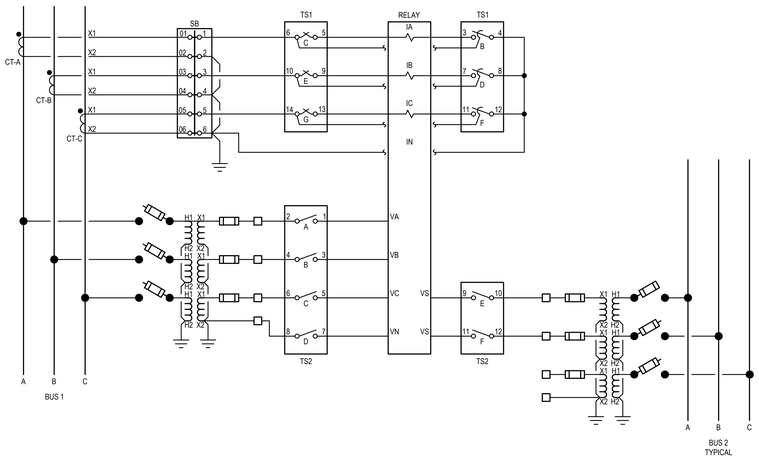

## 7 01 BREAKER CONTROL SWITCH DETAIL

SCALE: NOT TO SCALE



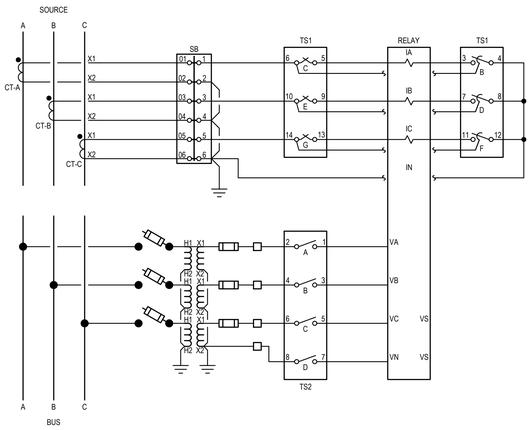

## 1 MAIN BREAKER CT/PT RELAY & METER TYPICAL DETAIL

SCALE: NOT TO SCALE




## 2 TIE BREAKER CT/PT RELAY TYPICAL DETAIL

SCALE: NOT TO SCALE




## 3 FEEDER BREAKER CT/PT FEEDER RELAY TYPICAL DETAIL

SCALE: NOT TO SCALE

## LIGHTING

SURFACE MOUNTED

**EXIT SIGNS - WALL MOUNTED**

SINGLE FACE

**EMERGENCY FIXTURE WITH BATTERY PACK**

DOUBLE HEAD

## LIGHTING CONTROL

y
$ SWITCH
X MOUNTING LOCATION: WALL
MOUNTING HEIGHT: 3'-6"
y=SWITCH DESIGNATION (lower case)
X=TYPE DEFINITION (SEE BELOW)

**TYPE DEFINITION:**

X=TYPE DEFINITION

3 = THREE-WAY SWITCH

## FIRE ALARM

SMOKE DETECTOR

## EQUIPMENT AND WIRING

PANELBOARD SURFACE MOUNTED

FUSED DISCONNECT SWITCH

MOLDED CASE CIRCUIT BREAKER

GROUND CONNECTION

## RECEPTACLES

**MOUNTING LOCATION: WALL**
**MOUNTING HEIGHT: 1'-6"**

DUPLEX RECEPTACLE

WP = WEATHERPROOF
GFCI = GROUND FAULT CIRCUIT INTERRUPTER

## SWITCHGEAR ELEVATION ABBREVIATIONS & LEGEND

| | | | |
|---|---|---|---|
| A | AMBER COLOR PILOT LIGHT | TS# | TEST SWITCH |
| B | BLUE COLOR PILOT LIGHT | VARM | KILOVAR METER |
| G | GREEN COLOR PILOT LIGHT | VM | AC VOLT METER |
| R | RED COLOR PILOT LIGHT | VMS | VOLT METER SELECTOR SWITCH |
| W | WHITE COLOR PILOT LIGHT | VS | VOLTAGE SYNC SOURCE |
| | | VT | VOLTAGE TRANSFORMER |
| AH | ALARM HORN | WM | MEGAWATT METER |
| AM | AMMETER | | |
| AMS | AMMETER SELECTOR SWITCH | A/H | UTILITY RETURN AUTO / HOLD SELECTOR SWITCH |
| AR | ALARM RESET PUSHBUTTON | A/M | AUTO / MANUAL SELECTOR SWITCH |
| AS | AUTO STANDBY MODE | C/O | CLOSED / OPEN TRANSITION |
| CPM | CHILLER PLANT MODE | R/L | REMOTE / LOCALE CONTROL SELECTOR SWITCH |
| FM | FREQUENCY METER | RET | INITIATE RETURN TO UTILITY |
| LT | LAMP TEST PUSHBUTTON | SYS | SYSTEM MODE SELECTOR SWITCH (AS-CPM-PU) |
| MOC | MECHANISM-OPERATED CONTACT | | |
| MTR | POWER METER | 01 | BREAKER CONTROL SWITCH |
| PU | PARALLEL WITH UTILITY MODE | 02 | GENERATOR MODE SELECTOR SWITCH (RUN-OFF-AUTO) |
| RTD | GENERATOR REMOTE TEMPERATURE ALARM | 03 | SYNCHROSCOPE SELECTOR SWITCH |
| RTM | RIDE THRU MODULE | 86 | LOCKOUT RELAY |
| SP | ALARM SILENCE PUSHBUTTON | 86B | BUS DIFFERENTIAL LOCKOUT RELAY |
| SS | SYNCHROSCOPE | 86BF | BREAKER FAILURE LOCKOUT RELAY |
| TOC | TRUCK-OPERATED CONTACT | | |

## LEGEND:

| | | | |
|---|---|---|---|
| MAIN RELAY | MULTI-FUNCTION MAIN PROTECTION RELAY | | NORMALLY OPEN CONTACT |
| TIE RELAY | MULTI-FUNCTION TIE PROTECTION RELAY | | NORMALLY CLOSED CONTACT |
| XFMR RELAY | MULTI-FUNCTION TRANSFORMER PROTECTION RELAY | | EMERGENCY STOP BUTTON |
| FDR RELAY | MULTI-FUNCTION FEEDER PROTECTION RELAY | | SYNC AND CLOSE PUSH BUTTON |
| PLC | PROGRAMMABLE LOGIC CONTROLLER | | WYE-WYE POTENTIAL TRANSFORMERS |
| MTR | POWER METER | | OPEN DELTA POTENTIAL TRANSFORMERS |
| SB | SHORTING TERMINAL BLOCK | | CURRENT TRANSFORMER, DOT INDICATES POLARITY |
| TS1 | TEST SWITCH TYPE 1, REFER TO SPECIFICATIONS | | MEDIUM VOLTAGE BREAKER |
| TS2 | TEST SWITCH TYPE 2, REFER TO SPECIFICATIONS | | LOW VOLTAGE BREAKER |
| TS3 | TEST SWITCH TYPE 3, REFER TO SPECIFICATIONS | | LOW VOLTAGE FUSE |
| 86 | LOCKOUT RELAY | | EQUIPMENT GROUND CONNECTION |
| 83 | CONTROL POWER TRANSFER RELAY SCHEME | | DIODE |
| 01 | BREAKER CONTROL SWITCH | | MULTI-FUNCTION RELAY OUTPUT |
| 43 | LOCAL/REMOTE SWITCH | # | MULTI-FUNCTION RELAY INPUT |
| CR | CONTROL RELAY | | SURGE ARRESTER |
| ## | ANSI PROTECTIVE FUNCTION | | |
| AMS | ARC FLASH MAINTENANCE MODE SWITCH | | |

## ANSI PROTECTIVE FUNCTIONS

| | | | | | |
|---|---|---|---|---|---|
| 25 | = | SYNC CHECK | 52 | = | CIRCUIT BREAKER |
| 26Q | = | LIQUID THERMAL RELAY | 59 | = | OVERVOLTAGE |
| 27 | = | UNDERVOLTAGE | 63PRD | = | PRESSURE RELIEF DEVICE |
| 32 | = | REVERSE POWER | 63VAC | = | VACUUM GAUGE |
| 43 | = | BREAKER CONTROL SWITCH | 63TX | = | SUDDEN PRESSURE RELAY |
| 47 | = | PHASE SEQUENCE | 71 | = | LIQUID LEVEL RELAY |
| 49W | = | WINDING THERMAL RELAY | 81U | = | UNDER-FREQUNECY |
| 50 | = | INSTANTANEOUS OVERCURRENT | 81O | = | OVER-FREQUENCY |
| 50N | = | NEUTRAL INSTANTANEOUS OVERCURRENT | 83 | = | CONTROL POWER AUTO-TRANSFER |
| 50G | = | GROUND INSTANTANEOUS OVERCURRENT | 86 | = | LOCKOUT RELAY |
| 51 | = | TIME OVERCURRENT | 87 | = | DIFFERENTIAL |
| 51N | = | NEUTRAL TIME OVERCURRENT | | | |
| 51G | = | GROUND TIME OVERCURRENT | | | |

## COMMUNICATIONS ARCHITECTURE LEGEND

| | | |
|---|---|---|
| | SINGLE MODE FIBER | MIN 12 STRAND |
| | SINGLE MODE FIBER BY OWNER | OR EXISTING |
| | MULTI-MODE FIBER | MIN 12 STRAND CABLE |
| | ETHERNET | CATEGORY 6A |
| | FUTURE ETHERNET | |
| | SERIAL | RS-485 CABLE |
| | COAXIAL | LMR-400 TNC TO TNC, SEL-C691 OR APPROVED EQUAL |
| SP | COAXIAL SURGE PROTECTOR | SEL-915900139 OR APPROVED EQUAL |
| | HARDWIRE | MIN 1-#14 AWG (OR QTY AS INDICATED) |
| | EXISTING HARDWIRE | |
| | FUTURE HARDWIRE | |
| | TERMINAL BLOCK | |
| | IRIG-B TIME SYNC | RG58 COAXIAL CABLE |
| | IRIG-B T CONNECTOR | BNC T CONNECTOR (FEMALE-FEMALE-FEMALE) AND BNC MALE TO BNC MALE OR DB-9 MALE CONNECTOR AT EACH DEVICE TERMINATION AS NECESSARY |
| R | IRIG-B RESISTOR | BNC 50 OHM TERMINATING RESISTOR (BASIS OF DESIGN SEL 240-1800) |
| S | SERIAL TERMINATION | SERIAL MALE TERMINATION FOR ETHERNET CABLE |
| DB9 | DB-9 PINOUT TERMINATION | EIA-485 ADAPTER FOR IRIG-B AND EIA-485 CONNECTIONS (BASIS OF DESIGN SEL-C675) |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NORTH CAROLINA PROFESSIONAL SEAL 032783 ENGINEER BRYON A. HOGE
10/18/24

Sheet Keynotes:

| Rev | Date | Description of Issue |
|---|---|---|
| | | |
| | | |
| | | |
| C | 10/18/24 | OWNER PREPURCHASED EQUIPMENT - REV 2 |
| B | 09/23/24 | OWNER PREPURCHASED EQUIPMENT - REV 1 |
| A | 08/02/24 | OWNER PREPURCHASED EQUIPMENT |

Project

THE UNIVERSITY *of* NORTH CAROLINA *at* CHAPEL HILL

**Chilled Water Infrastructure Expansion**

**SCO# 22-25588-02C**
**CODE: 42123-355 / 42323-305**
**UNC BLDG. NO 227**

Sheet Title

**SWGR ELEVATION & DETAILED SINGLE LINE DIAGRAM SYMBOLS, ABBREVIATIONS, & DETAILS**

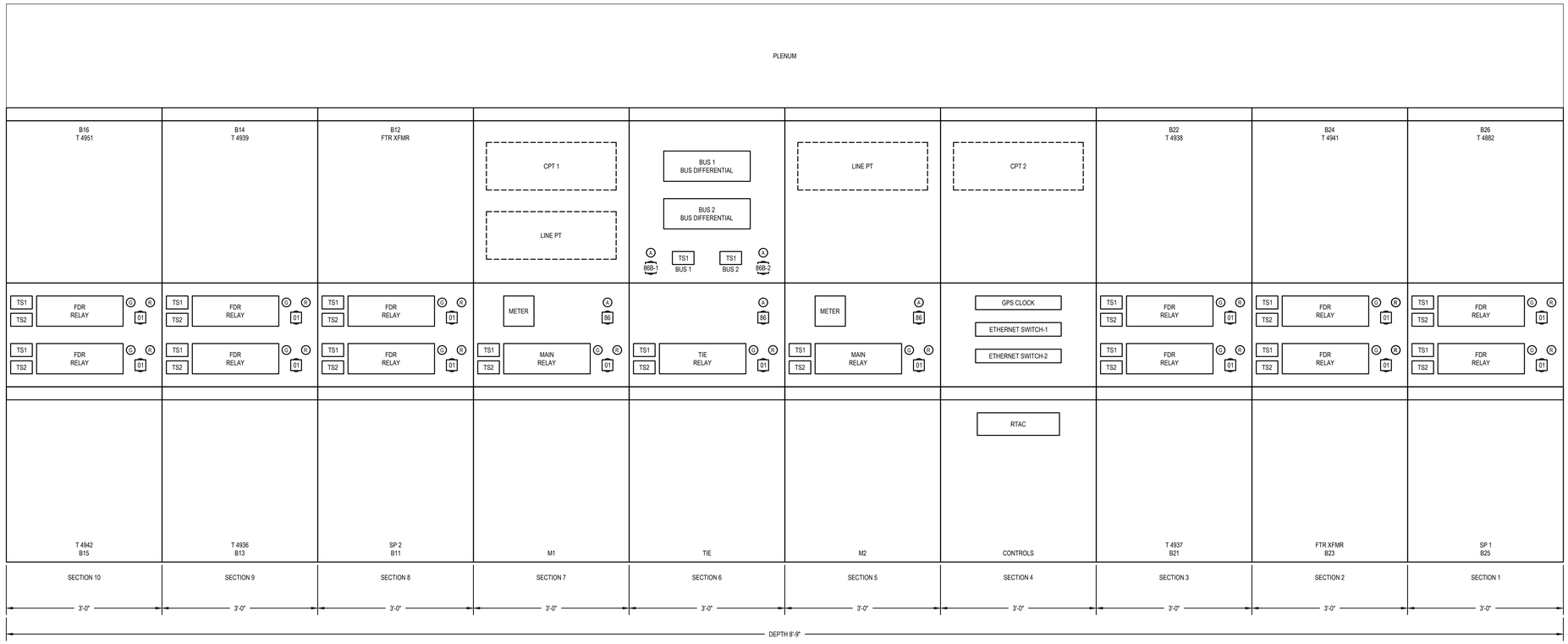
Scale: NONE

Date: 05/17/24 | Drawn By: JLC

Project No.: 23480-03 | Checked By: BAH

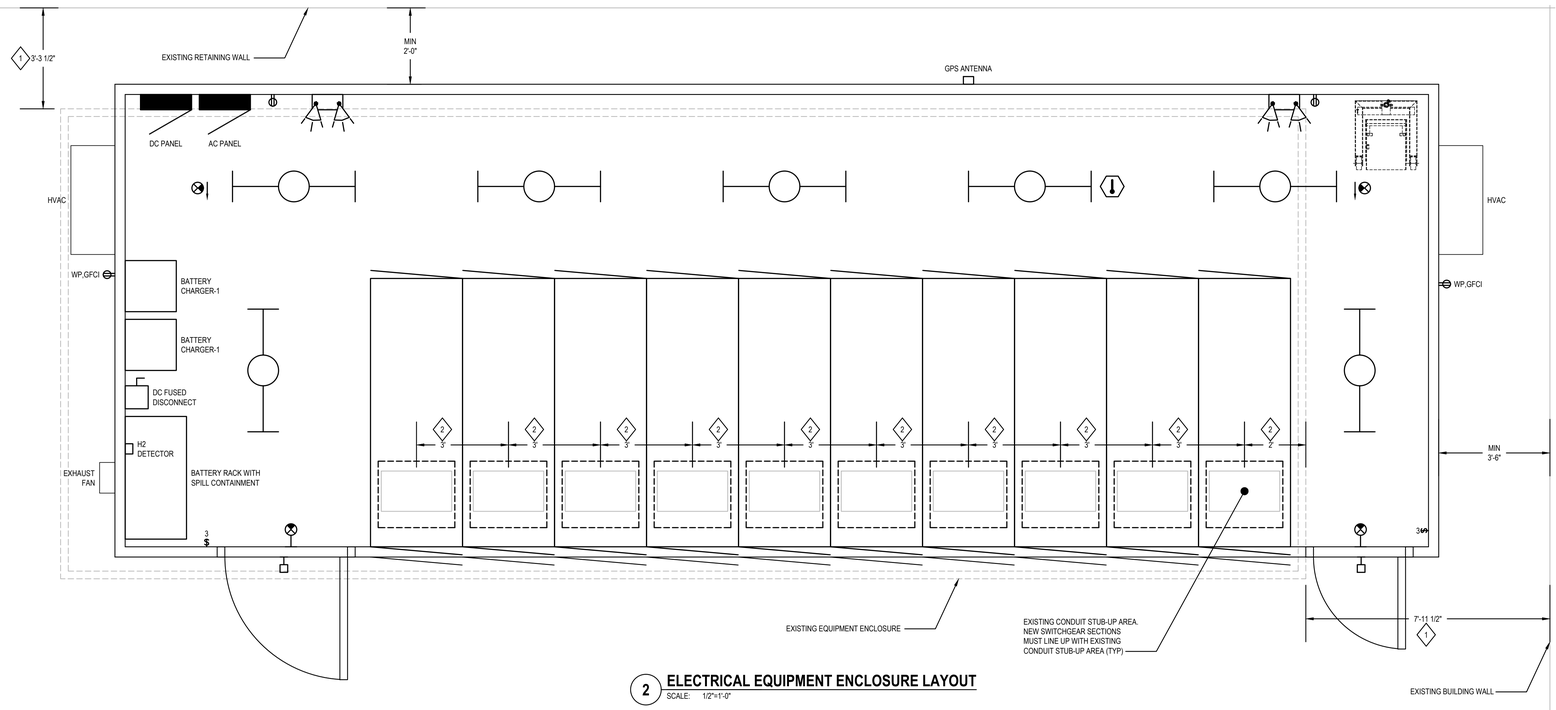
Sheet No.

**N.E.600**




## 1 ELECTRICAL EQUIPMENT ELEVATION

SCALE: NONE




## 2 ELECTRICAL EQUIPMENT ENCLOSURE LAYOUT

SCALE: 1/2"=1'-0"

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SEAL
032783
ENGINEER
BARTON A. HOGE

10/18/24

Sheet Keynotes:

1. DIMENSION FROM EXISTING EQUIPMENT ENCLOSURE BASED ON FIELD MEASUREMENTS.
2. DIMENSION BASED ON EXISTING SWITCHGEAR SHOP DRAWINGS.

| Rev | Date | Description of Issue |
|---|---|---|
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| | | |
| C | 10/18/24 | OWNER PREPURCHASED EQUIPMENT - REV 2 |
| B | 09/23/24 | OWNER PREPURCHASED EQUIPMENT - REV 1 |
| A | 08/02/24 | OWNER PREPURCHASED EQUIPMENT |

Project

THE UNIVERSITY *of* NORTH CAROLINA *at* CHAPEL HILL

**Chilled Water Infrastructure Expansion**

**SCO# 22-25588-02C**
**CODE: 42123-355 / 42323-305**
**UNC BLDG. NO 227**

Sheet Title

# ELECTRICAL EQUIPMENT ELEVATION & ENCLOSURE LAYOUT

Scale: NONE

Date: 05/17/24 Drawn By: JLC

Project No.: 23480-03 Checked By: BAH

Sheet No.

# N.E.601

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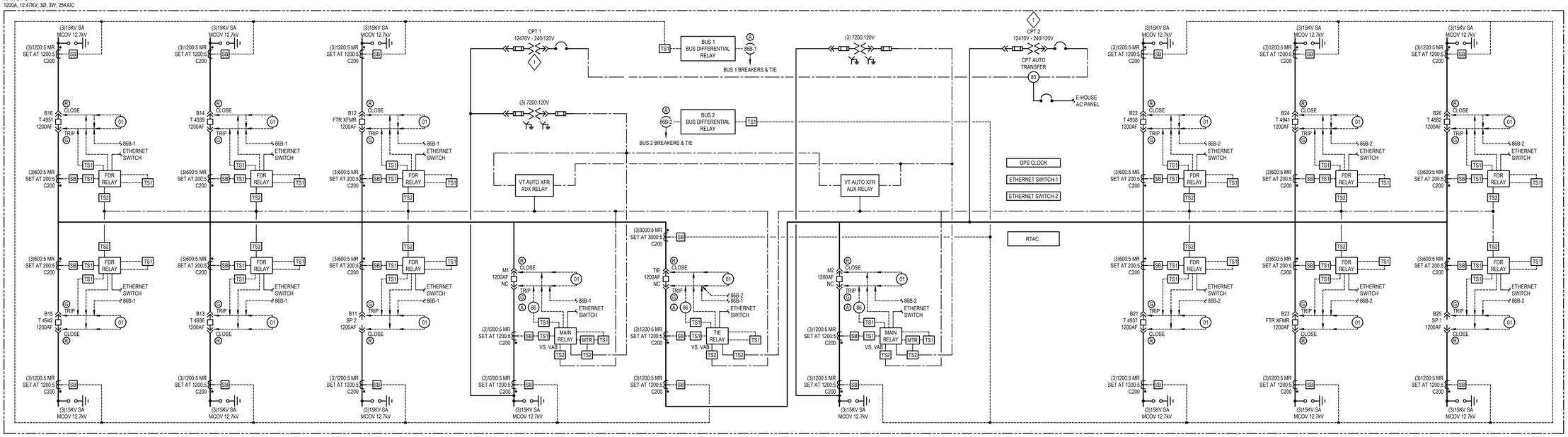
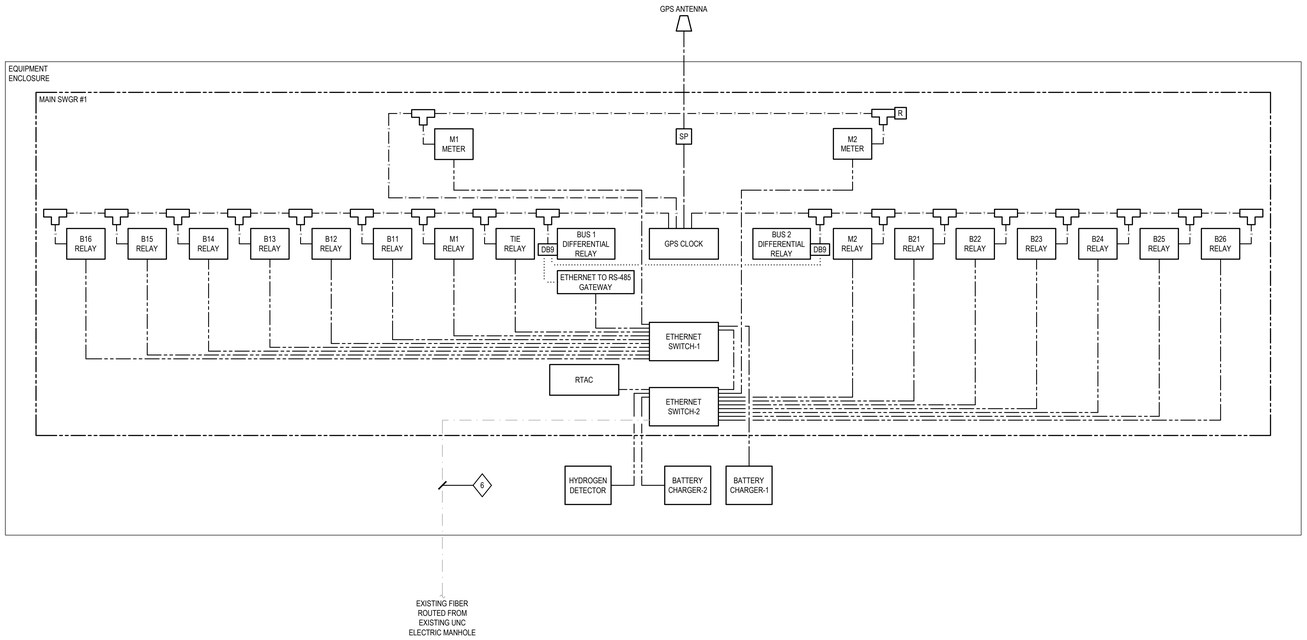
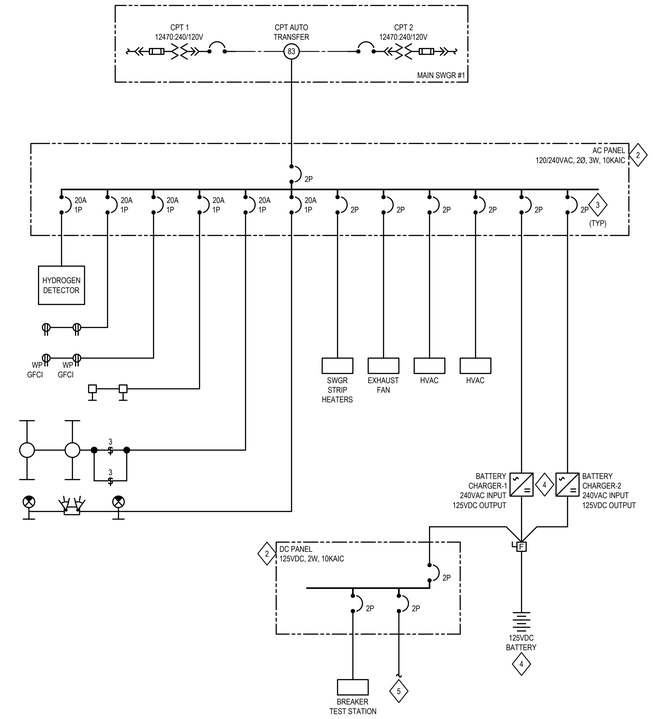
MAIN SWGR #1
1200A, 12.47KV, 3Ø, 3W, 25KAIC




## 1 DETAILED SINGLE LINE DIAGRAM
SCALE: NONE




## 3 COMMUNICATIONS SINGLE LINE DIAGRAM
SCALE: NONE




## 2 EQUIPMENT ENCLOSURE LOW VOLTAGE SINGLE LINE DIAGRAM
SCALE: NONE

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 032783 BRIONA A. HOGE
10/18/24

Sheet Keynotes:

1. CONTROL POWER TRANSFORMER KVA RATING DETERMINED BY SWITCHGEAR/EQUIPMENT ENCLOSURE MANUFACTURER.
2. PANEL AMPACITY RATING DETERMINED BY SWITCHGEAR/EQUIPMENT ENCLOSURE MANUFACTURER.
3. CIRCUIT BREAKER AMPACITY RATING DETERMINED BY SWITCHGEAR/EQUIPMENT ENCLOSURE MANUFACTURER.
4. BATTERY CHARGER/BATTERY SYSTEM SIZE DETERMINED BY SWITCHGEAR MANUFACTURER PER REQUIREMENTS OF SPECIFICATION 26 1319.1.
5. QUANTITY OF DC CIRCUITS TO SWITCHGEAR FOR CONTROL POWER DETERMINED BY SWITCHGEAR MANUFACTURER.
6. INSTALLING CONTRACTOR SHALL RE-INSTALL AND TERMINATE EXISTING FIBER AT EXISTING EQUIPMENT ENCLOSURE LOCATION.

| Rev | Date | Description of Issue |
|---|---|---|
| | | |
| | | |
| C | 10/18/24 | OWNER PREPURCHASED EQUIPMENT - REV 2 |
| B | 09/23/24 | OWNER PREPURCHASED EQUIPMENT - REV 1 |
| A | 08/02/24 | OWNER PREPURCHASED EQUIPMENT |

Project

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**Chilled Water Infrastructure Expansion**
**SCO# 22-25588-02C**
**CODE: 42123-365 / 42323-305**
**UNC BLDG. NO 227**

Sheet Title

**DETAILED SINGLE LINE DIAGRAMS**

Scale: NONE

Date: 05/17/24 — Drawn By: JLC

Project No.: 23480-03 — Checked By: BAH

Sheet No.

# N.E.602

GENERAL NOTES:

1. BREAKER CONTROL SCHEMATICS DEPICTED ON THIS PAGE PROVIDED FOR INTENT ONLY. FINAL SCHEMATICS TO BE DEVELOPED BY SWITCHGEAR MANUFACTURER AND SUBMITTED FOR APPROVAL.

SHEET KEYNOTES:

1. BUS 1 BUS DIFFERENTIAL LOCKOUT APPLICABLE FOR MAIN BREAKER M1. BUS 2 BUS DIFFERENTIAL LOCKOUT APPLICABLE FOR MAIN BREAKER M2.
2. OUTPUT AVAILABLE WHEN REMOTE ENABLED PUSH BUTTON ON RELAY IS ACTIVE.


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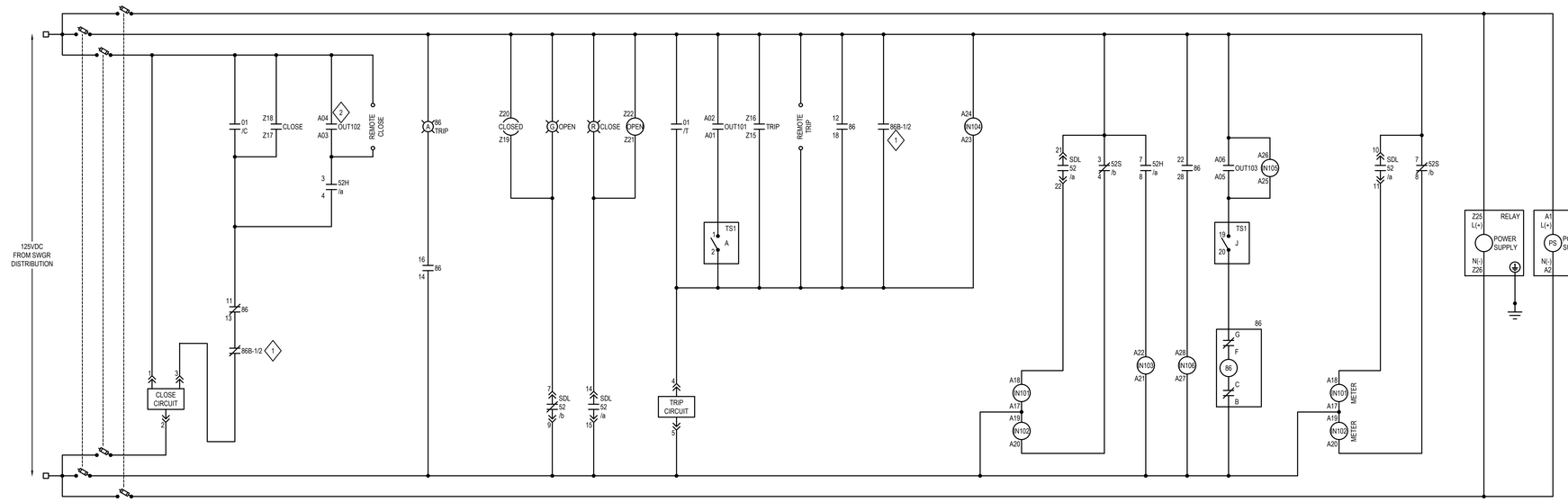
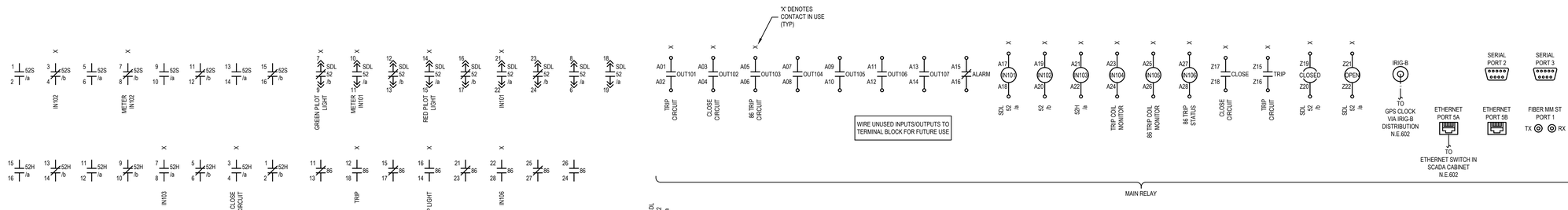
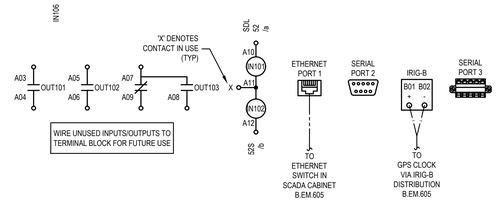
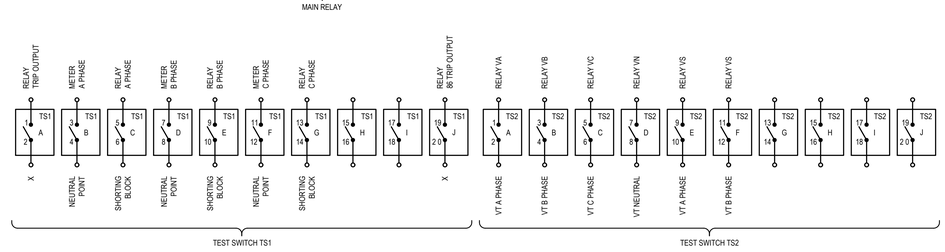
10/18/24

Sheet Keynotes:



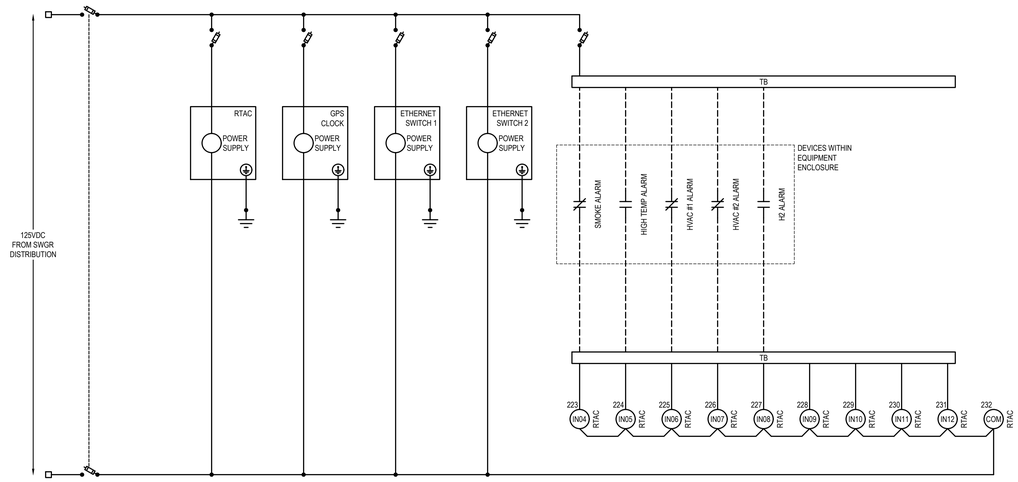




## 1 TYPICAL MAIN BREAKER CONTROL SCHEMATIC

SCALE: NOT TO SCALE




## 2 CONTROL/COMMUNICATION CONTROL POWER SCHEMATIC

SCALE: NOT TO SCALE

| Rev | Date | Description of Issue |
|---|---|---|
| | | |
| | | |
| C | 10/18/24 | OWNER PREPURCHASED EQUIPMENT - REV 2 |
| B | 09/23/24 | OWNER PREPURCHASED EQUIPMENT - REV 1 |
| A | 08/02/24 | OWNER PREPURCHASED EQUIPMENT |

Project

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**Chilled Water Infrastructure Expansion**

**SCO# 22-25588-02C**
**CODE: 42123-355 / 42323-305**
**UNC BLDG. NO 227**

Sheet Title

**TYPICAL MAIN BREAKER CONTROL SCHEMATIC & CONTROL/COMM POWER SCHEMATIC**

Scale: NONE

Date: 05/17/24 | Drawn By: JLC

Project No.: 23480-03 | Checked By: BAH

Sheet No.

**N.E.603**

GENERAL NOTES:

1. BREAKER CONTROL SCHEMATICS DEPICTED ON THIS PAGE PROVIDED FOR INTENT ONLY. FINAL SCHEMATICS TO BE DEVELOPED BY SWITCHGEAR MANUFACTURER AND SUBMITTED FOR APPROVAL.

SHEET KEYNOTES:

1. BUS 1 DIFFERENTIAL LOCKOUT APPLICABLE FOR BUS 1 BREAKERS. BUS 2 DIFFERENTIAL LOCKOUT APPLICABLE FOR BUS 2 BREAKERS.
2. OUTPUT AVAILABLE WHEN REMOTE ENABLED PUSH BUTTON ON RELAY IS ACTIVE.


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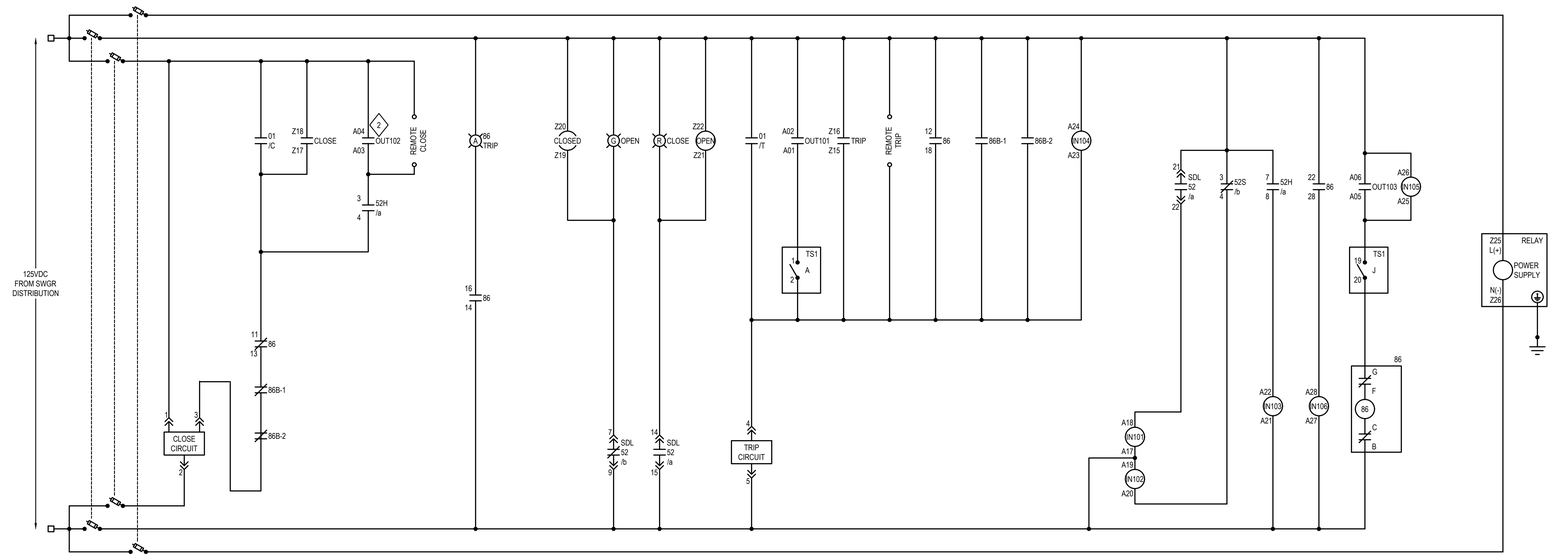
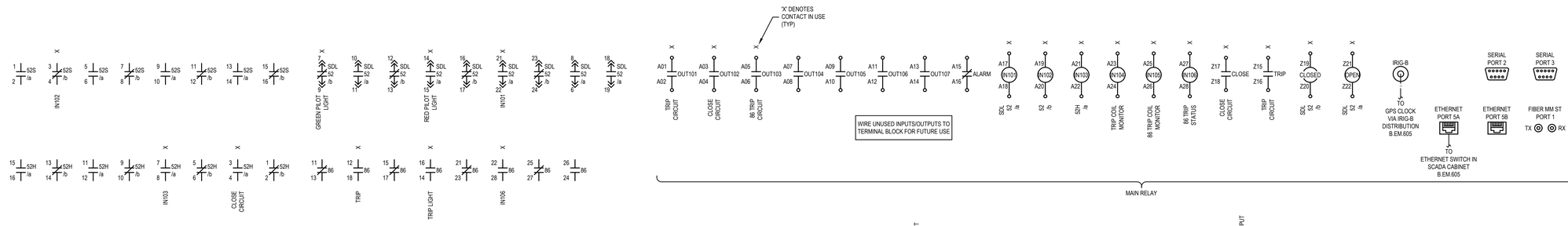
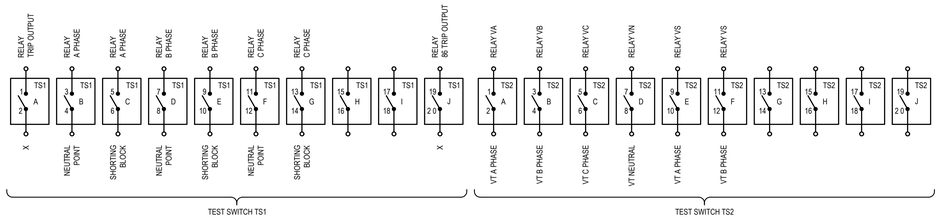
Sheet Keynotes:



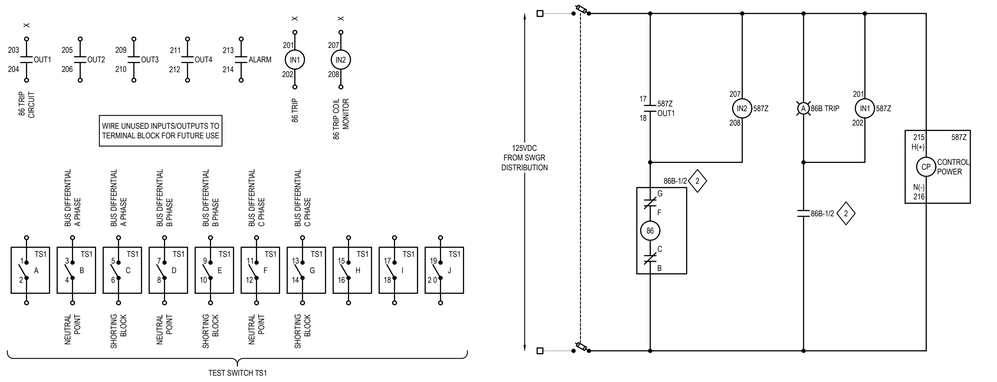




## 1 TIE BREAKER CONTROL SCHEMATIC

SCALE: NOT TO SCALE








## 2 TYPICAL BUS DIFFERENTIAL CONTROL SCHEMATIC

SCALE: NOT TO SCALE

| Rev | Date | Description of Issue |
|---|---|---|
| | | |
| | | |
| C | 10/18/24 | OWNER PREPURCHASED EQUIPMENT - REV 2 |
| B | 09/23/24 | OWNER PREPURCHASED EQUIPMENT - REV 1 |
| A | 08/02/24 | OWNER PREPURCHASED EQUIPMENT |

Project

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

**Chilled Water Infrastructure Expansion**

**SCO# 22-25588-02C**
**CODE: 42123-355 / 42323-305**
**UNC BLDG. NO 227**

Sheet Title

# TIE BREAKER CONTROL SCHEMATIC & BUS DIFFERENTIAL

Scale: NONE

Date: 05/17/24 | Drawn By: JLC

Project No.: 23480-03 | Checked By: BAH

Sheet No.

# N.E.604

GENERAL NOTES:

1. BREAKER CONTROL SCHEMATICS DEPICTED ON THIS PAGE PROVIDED FOR INTENT ONLY. FINAL SCHEMATICS TO BE DEVELOPED BY SWITCHGEAR MANUFACTURER AND SUBMITTED FOR APPROVAL.

SHEET KEYNOTES:

1. BUS 1 BUS DIFFERENTIAL LOCKOUT APPLICABLE FOR BUS 1 BREAKERS. BUS 2 BUS DIFFERENTIAL LOCKOUT APPLICABLE FOR BUS 2 BREAKERS.
2. OUTPUT AVAILABLE WHEN REMOTE ENABLED PUSH BUTTON ON RELAY IS ACTIVE.


Affiliated Engineers

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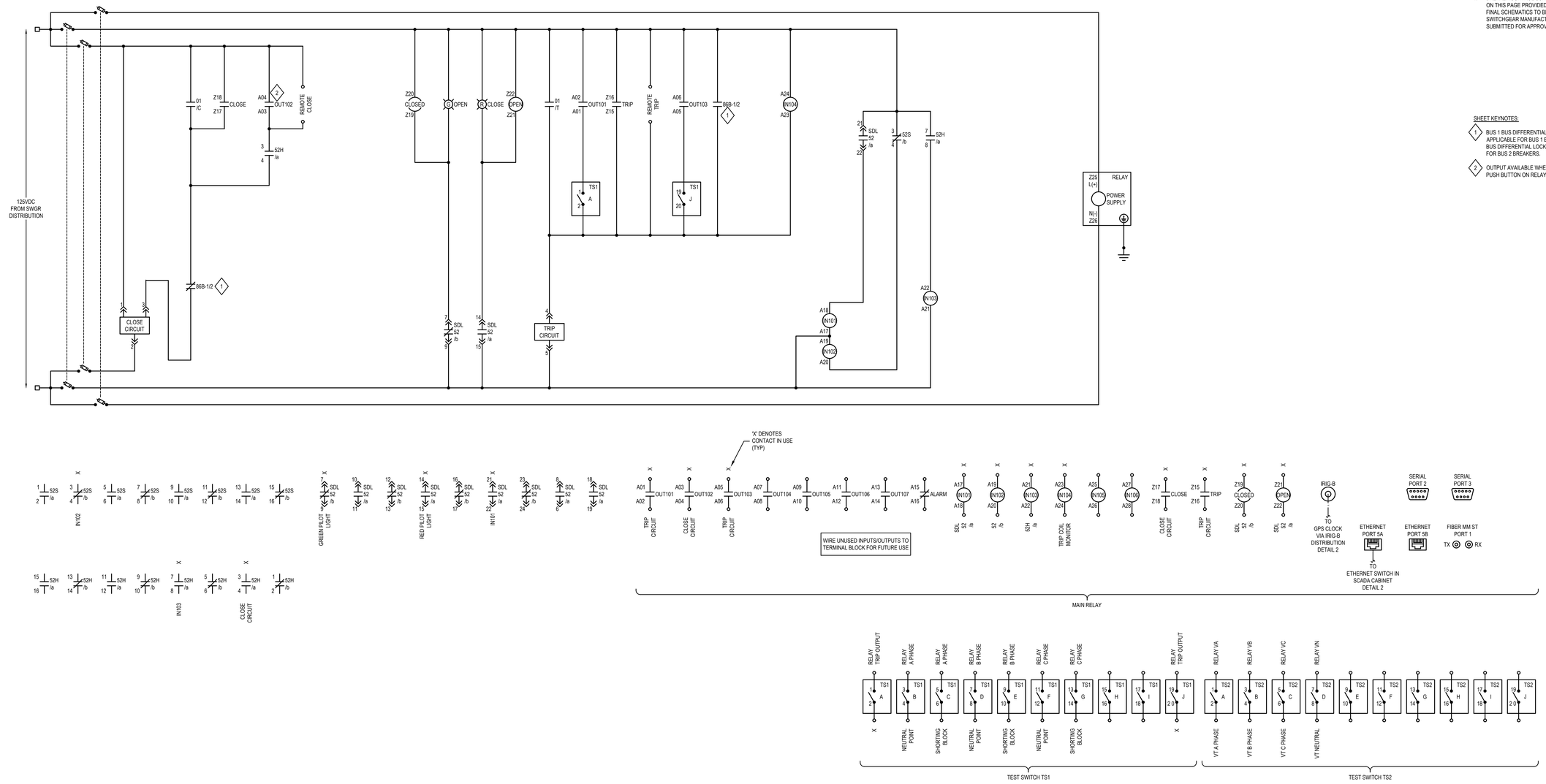
NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 032783 BRYON A. HOGE
10/18/24

Sheet Keynotes:




## 1 TYPICAL FEEDER BREAKER CONTROL SCHEMATIC

SCALE: NOT TO SCALE

| Rev | Date | Description of Issue |
|---|---|---|
| | | |
| | | |
| C | 10/18/24 | OWNER PREPURCHASED EQUIPMENT - REV 2 |
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**TYPICAL FEEDER BREAKER CONTROL SCHEMATIC**

Scale: NONE

Date: 05/17/24 | Drawn By: JLC

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Sheet No.

**N.E.605**