

UNIVERSITY OF
ARKANSAS

NCP Modernization Chiller Replacement

Contract #RA1194053

Electrical Equipment Pre-Purchase Package

Submitted by:



AEI Project No. 19223-00

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SECTION 26 2413

SWITCHBOARDS

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- D. Section 26 0553 – Electrical Systems Identification
- E. Section 26 0812 – Power Distribution Acceptance Tests
- F. Section 26 0813 – Power Distribution Acceptance Test Tables

1.3 REFERENCE

- A. Work under this section is subject to requirements of Contract Documents including General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements.

1.4 DESCRIPTION

- A. Equipment shall be Owner Furnished, Contractor Installed (OFCI). Contractor shall be responsible with scheduling and coordination of installation of equipment with owner and equipment manufacturer. All cabling, conduit, and other work necessary to make operation shall be Contractor Furnished, Contractor Installed (CFCI).
- B. Section includes free-standing, dead-front type low-voltage distribution switchboards.
- C. This specification is for equipment identified on the drawings as follows:
 - 1. NCHP-SE-A
 - 2. NCHP-SE-B
 - 3. NCHP-MDP

1.5 REFERENCE STANDARDS

- A. ANSI/IEEE C37.13 – Low-Voltage AC Power Circuit Breakers Used in Enclosures
- B. ANSI/NECA 400 – Recommended Practice for Installing and Maintaining Switchboards
- C. IEEE C62.41.1 Guide on the Surges Environment in Low-Voltage (1000 V and Less) AC Power Circuits

- D. IEEE C62.41.2 Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits
- E. NFPA 70 – National Electrical Code
- F. NEMA AB 1 – Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit Breaker Enclosures
- G. NEMA AB 3 – Molded-Case Circuit Breakers and Their Applications
- H. NEMA FU 1 – Low-Voltage Cartridge Fuses
- I. NEMA KS 1 – Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)
- J. NEMA PB 2 – Dead-Front Distribution Switchboards
- K. NEMA PB 2.1 – General Instructions for Proper Handling, Installation and Maintenance of Dead-Front Distribution Switchboards Rated 600 Volts or Less
- L. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum)
- M. UL 98 – Enclosed and Dead-Front Switches
- N. UL 486A-486B – Wire Connectors
- O. UL 489 – Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
- P. UL 869A – Reference Standard for Service Equipment
- Q. UL 891 – Dead-Front Switchboards
- R. UL 1053 – Ground-Fault Sensing and Relaying Equipment
- S. UL 1066 – Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures

1.6 SUBMITTALS

- A. Product Data: For each switchboard, components and accessories indicated:
 - 1. Include data on features and components and complete description; submit catalog cut sheets showing voltage, size, rating and size of surge protective devices, switching and overcurrent protective devices.
 - 2. Features, characteristics, factory settings and time-current curves of individual protective devices, auxiliary components and ground fault relaying.
- B. Shop Drawings:
 - 1. For each switchboard specified in this Section:
 - a. General Arrangement:
 - 1). Indicate front, plan, and side views of switchboards; access requirements (front, side, rear); overall dimensions and components list; shipping splits and weights.
 - 2). Front elevation indicating location of devices and instruments.
 - 3). Sections through switchboard showing space available for conduits.
 - b. Conduit entrance locations and requirements.
 - c. Nameplate legends.
 - d. Configuration, size and number of bus bars for each phase and current rating of buses.

- e. Ground bus.
 - f. Neutral bus.
 - g. Short circuit ratings of switchboards and overcurrent protective devices, and bus withstand rating.
 - h. Instrument details; enclosure types and details.
 - i. Wiring diagrams: power, signal and control wiring.
 - j. Descriptive documentation of optional barriers specified for electrical insulation and isolation.
- C. 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.
- D. Test Reports: Indicate field test and inspection procedures and interpret test results and corrective action taken for compliance with specification requirements.
- E. Complete review of this specification noting for each paragraph whether proposed equipment complies with project specifications or deviates. Justification must be given for each deviation.
- F. Closeout Submittals:
- 1. Project Record Documents:
 - a. Record actual locations, configurations, and ratings of switchboard 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.
 - 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.
 - d. Include Manufacturer Seismic Qualification Certification and Installation Seismic Qualification Certification.
 - e. Include time-current curves, including selectable ranges for each type of overcurrent protective device.

1.7 QUALITY ASSURANCE

- A. Obtain switchboards 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 Underwriters Laboratories, Inc., as suitable for purpose specified and indicated.

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 switchboards as required to prevent condensation.

- B. Deliver switchboards 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.
- C. Handle switchboards in accordance with NEMA PB 2.1 and ANSI/NECA 400. Use factory-installed lifting provisions. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

1.9 WARRANTY

- A. Manufacturer shall provide standard 1 yr warranty against defects in materials and workmanship for products specified in this Section. Warranty period shall begin on date of substantial completion.

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, but no fewer than 2 of each size and type.
 - 2. Control-Power Fuses: Equal to 10% of amount installed for each size and type, but no fewer than 2 of each size and type.
 - 3. Fuses for Fused Switches and for Fused Circuit Breakers: Equal to 10% of amount installed for each size and type, but no fewer than 3 of each size and type.
 - 4. Indicating Lights: Furnish 6 of each type required. Equal to 10% of amount installed for each size and type, but no fewer than 2 of each size and type.
 - 5. Spare Breakers:
 - a. Provide line-Item pricing per spare breaker as bid alternate:
 - b. Spare breaker shall match features, functionality and trip unit as provided with the distribution panel board indicated by this specification as indicated in the drawings.
 - 1). 1200 AF
 - 2). 1600 AF
 - 3). 2000 AF
 - 4). 3000 AF

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. ABB
- B. Eaton
- C. Square D

2.2 RATINGS

- A. Nominal system voltage: As indicated on the drawings or scheduled.
- B. Main bus continuous amp: As indicated on the drawings or scheduled.
- C. Short circuit current rating: As indicated on drawings.

- D. Brace switchboard components to withstand mechanical forces for symmetrical fault current shown.

2.3 CONSTRUCTION

- A. NEMA PB 2, UL 891
- B. Free-standing, dead-front type; vertical sections bolted together; sides and rear covered with removable bolt-on covers; adequate ventilation within enclosure; supporting frame: steel angles rigidly fastened together, with same outside dimensions as the enclosure.
- C. Adequate strength and rigidity necessary to resist conditions of use to which it may be subjected and to support equipment, devices and appurtenances contained therein.
- D. Incoming/Outgoing lug locations: Bottom Entry
 - 1. NCHP-SE-A & NCHP-SE-B
 - a. Bottom Entry
 - b. (6-8) sets of 500-750kCMIL per phase and neutral
 - c. Mechanical type suitable for copper conductor
 - 2. NCHP-MDP
 - a. Top Entry
 - b. Mechanical type suitable for copper conductor
 - c. Main Incoming Conductors: (6-8) sets of 500-750kCMIL per phase and neutral
 - d. Feeder Outgoing Conductors: (3-5) sets of 350-600kCMIL per phase and neutral
- E. Environmental Limitations:
 - 1. Ambient temperatures: Not exceeding 40°C.
 - 2. Altitude: Not exceeding 2 km
 - 3. Temperature rise: Not to exceed 65°C over a 40°C ambient environment, with no derating required.
- F. Device Mounting and Type:
 - 1. Front accessible switchboard: Front and rear aligned:
 - a. Main and Tie device: Individually mounted insulated-case.
 - b. Feeder device: Individually mounted molded-case.
- G. Bus:
 - 1. Material: Copper: 98% conductivity. The bus bars shall have sufficient cross-sectional area to meet UL 891 temperature rise requirements through actual tests. The bus bars shall be standard density rated for 1000 amperes per square inch copper.
 - 2. Connections:
 - a. Bolted:
 - 1). Not fewer than 4 bolts for each 4" x 4" contact.
 - 2). Not fewer than 2 bolts for each 2" x 2" contact.
 - 3). Grade 5 bolts and conical spring-type washers.
 - 4). Clamp joints are not allowed.
 - 3. Sizing: Standard size, based on 65°C over 40°C.
 - 4. Main Phase Buses: Three phase, 3 or 4 wire as indicated on drawings; fully rated; uniform capacity for entire length of switchboard; ampacity as indicated on drawings; rated for the main protective device frame size or main incoming conductors.

5. All feeder device line and load connection straps: Rated to carry current rating of device frame (not trip rating).
 6. Support for Buses: Mounted on high-impact, non-tracking insulated supports; joints in the vertical bus are not permitted.
 7. Bus arrangement: A-B-C (left to right, top to bottom, front to rear).
- H. Ground Bus: Extend length of switchboard.
1. 1/4" x 2" minimum-size, hard-drawn copper of 98 percent conductivity, equipped with pressure connectors for feeder ground conductors. For busway feeders, extend insulated equipment grounding cable to busway ground connection.
- I. Neutral Bus: 100% of the ampacity of phase buses, equipped with pressure connectors for outgoing circuit neutral cables. Bus extensions for busway feeder neutral bus are braced.
- J. Hinged Front Doors: Allow access to metering and accessory compartments; concealed hinges; fastened by head bolts.
- K. Cable Supports: For each vertical section.
- L. Barriers: Between adjacent sections.
- M. Hinged Front Doors: Over device compartments, with concealed hinges and fastened by hex head bolts.
- N. Adequate lifting means.
- O. Dimensions: 92" maximum height, excluding floor sills, lifting members and pull boxes. Length and depth indicated on the drawing are maximum allowed.
- P. Enclosure:
1. NCHP-SE-A & NCHP-SE-B: Steel, NEMA 250, Type 3R
 - a. Outdoor Non-walk-in Enclosure: Lifting plates at base of structure, hinged aisle doors with rubber gaskets and padlocking provision, asphalt base undercoating on exterior bottom, space heater per vertical section, and space heater switch.
 - 1). Space Heater: Factory-installed electric space heater of sufficient wattage in each vertical section to maintain enclosure temperature above expected dew point.
 - a). Space-Heater Control: Thermostats to maintain temperature of each section above expected dew point.
 - b). Space-Heater Power Source: Transformer, factory installed in switchboard.
 - b. Enclosure Finish for Outdoor Units: Factory-applied finish in manufacturer's standard color, undersurfaces treated with corrosion-resistant undercoating.
 2. NCHP-MDP: Steel, NEMA 250, Type 1
 - a. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.
- Q. Mimic Bus: Continuously integrated mimic bus factory applied to front of switchboard. Arrange in single-line diagram format showing bussing, connections and devices using symbols and letter designations consistent with final mimic-bus diagram. Use black plastic strips, fastened flat against panel face with corrosion-resistant screws and rivets. Coordinate mimic-bus segments with devices in switchboard sections to which they are applied. Produce a concise visual presentation of principal switchboard components and connections.

2.4 SHORT CIRCUIT CURRENT RATING

- A. Each switchboard with minimum short circuit current rating as indicated on drawings.

- B. Switchboards: Marked with their maximum short circuit current rating at supply voltage.
- C. Switchboards: Fully rated. Series rated switchboards are not acceptable.

2.5 SERVICE ENTRANCE RATED

- A. UL 869A
- B. Switchboards labeled as suitable for use as service entrance equipment, where applicable, with incoming line isolation barriers, and a removable neutral bond to switchboard ground for solidly grounded wye systems.
- C. NCHP-SE-A & NCHP-SE-B Only:
 - 1. Surge arrestors on all phases: per requirements in Section 26 4300 – Surge Protective Devices.

2.6 OVERCURRENT PROTECTIVE DEVICES

- A. Enclosed, Insulated-Case Circuit Breaker and Accessories: NEMA AB 1, UL 489; fully rated circuit breaker with interrupting capacity rating to meet available fault current.
 - 1). Fixed (individually) circuit breaker mounting.
 - 2). Two-step, stored-energy closing; electrically operated.
 - 3). A charging handle, closed pushbutton, open pushbutton and Off/On/Charge indicator located on the breaker escutcheon and visible with the breaker compartment closed.
 - 4). Local and remote trip indication and control.
 - 5). Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit breaker contacts, "b" contacts operate in reverse of circuit breaker contacts.
 - 6). Communication Capability: Integral communication module with functions and features compatible with power monitoring and control system specified in Section 26 0913 – Electrical Power Monitoring and Control.
 - 7). Key Interlock Kit (where indicated on drawing): Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
 - 8). Control Voltage: 120 VAC.
 - 9). Listed for 100% of breaker's continuous ampere rating.
- B. Molded-Case Circuit Breaker: NEMA AB 1, NEMA AB 3, UL 489; lockable handle; interrupting capacity to meet available fault current.
 - 1). Electronic (solid-state microprocessor based) trip unit circuit breakers.
- C. Circuit Breaker Electronic Trip Units general characteristics:
 - 1. Circuit breakers, with solid-state microprocessor based trip units:
 - a. Unit shall consist of current sensors, solid-state trip device, and solid-state adjustable time/current curve shaping elements.
 - b. Trip units shall be removable to allow for field upgrades.
 - c. Trip units shall incorporate "True RMS Sensing."
 - 2. Solid-state elements shall provide functions as indicated above.
 - 3. Adjustments shall be made using non-removable, discrete steps.
 - 4. Sealable transparent cover shall be provided over adjustments.
 - 5. Adjustable long-time pickup (Ir) and delay shall be available in an adjustable rating plug that is UL listed as field-replaceable. Adjustable rating plug shall allow for five minimum long-time pickup settings from 0.4 to 1.0 times the sensor plug (In). Other adjustable rating plugs

shall be available for more precise settings to match the application. Long-time delay settings shall be at least three bands.

6. Short-time pickup shall allow for five minimum settings from 1.5 to 10 times I_r . Short-time delay shall be at least three bands with I_{2t} ON and OFF.
 7. Instantaneous settings on the trip units shall be available in five minimum bands from 2 to 15 times I_n .
 8. Trip unit shall indicate:
 - a). Long-time and short-time pickup levels
 - b). Long-time and short-time time delay adjustments with I_{2t} response
 - c). Instantaneous trip pickup level and time delay
 - d). Ground-fault pickup level, time delay, and I_{2t} response.
 9. Trip unit shall provide local trip indication and capability to indicate local and remote reason for trip, i.e., overload, short circuit or ground fault.
 10. Trip unit shall contain means to conduct circuit breaker test, or via separate test kit.
 11. Breaker shall be equipped with externally accessible test points to be used for field testing.
 12. Trip units shall be provided with the following standard features:
 - a. True RMS sensing
 - b. LI
 - c. LSI
 - d. LSIG/Ground-fault trip
 - e. Ground Fault Alarm (no trip), with external relay, where required
 - f. Adjustable rating plugs
 - g. Power measurement
 - h. Maximum peak demand (measure of average power over a 15-minute period) continuously recorded over a one-year period
 13. Circuit Breakers 1200A and greater: Arc Flash Reduction Settings with switch to initiate arc flash reduction settings and blue LED to indicate.
- D. Ground Fault protection equipment on breakers, where indicated: Integrally mounted relay and trip unit, push-to-test feature and ground fault indicator:
1. Ground-fault protection with at least three adjustable short-time delay settings and three trip-time delay bands; adjustable current pickup with maximum setting of 1200 amps. Arrange to provide protection for the following:
 - a. Four-wire circuit or system
 2. Neutral current transformers shall be provided for 4-wire system.
 3. Ground fault system on switchboard interconnected via main-tie-tie-main arrangement shall utilize Modified Differential Ground Fault detection or other approved method for detecting ground faults and limiting false trip events.

2.7 CONTROL POWER, COMPONENTS IDENTIFICATION, AND CONTROL WIRING

- A. Control Circuits: 120 V, supplied through secondary disconnecting devices from control-power transformer: Dry-type transformers in separate compartments for units larger than 3 KVA, including primary and secondary fuses.
- B. Control-Power Fuses: Primary and secondary fuses for current-limiting and overload protection of transformer and fuses for protection of control circuits.

- C. Control components mounted within assembly, such as relays, pushbuttons, switches etc.: Suitably marked for identification, corresponding to appropriate designations on manufacturer's wiring diagrams.
- D. Control Wiring: Factory installed, with bundling, lacing, and protection included; flexible conductors for #8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units; insulated locking spade terminals for control connections, except where saddle type terminals, integral to a device; current transformer secondary leads, connected to short circuit terminal blocks; terminal blocks with suitable numbering strips for group of control wires leaving switchgear, with wire markers at each end of control wiring.
- E. NCHP-MDP Only:
 - 1. Provide control power transformer upstream of each main. Provide relay to allow either control power transformer to supply power to control circuit for switchboards arranged in main-tie-main configuration.

2.8 ACCESSORY COMPONENTS AND FEATURES

- A. Furnish portable test set to test functions of solid-state trip devices without removal from switchboard. Include relay and meter test plugs suitable for testing switchboard meters and switchboard class relays.
- B. Lockout Devices: Circuit breakers with integral, lockout/tagout devices.

2.9 CUSTOMER METERING

- A. NCHP-MDP Only
 - 1. Per requirements in Section 26 27 13 – Electrical Metering.
 - 2. Locate Current Transformer Shorting Block and voltage fuse block within separate compartment for use with external wiring to externally mounted meters.
 - a. Compartment may be same compartment as control power transformer.
 - b. Meter and external enclosure shall be Owner Furnished, Contractor Installed (OFCI).

PART 3 - EXECUTION BY MANUFACTURER

3.1 COORDINATION

- A. Verify that "touch-up" paint kit is available for repainting.
- B. Coordinate field service activity with installing contractor.

3.2 MANUFACTURER'S FIELD SERVICE

- A. Engage a factory-authorized service representative to inspect and adjust field assembled components and equipment installation, including connections.
- B. Prior to energization, factory representative shall visually inspect switchgear installation to ensure that switches and motor operators are operable and bus connections are complete.
- C. Switch operators shall be tested once after energization.
- D. Measure primary and secondary voltages and make appropriate tap adjustments.
- E. Provide copy of manufacturer's representative's certification

PART 4 - EXECUTION BY INSTALLING CONTRACTOR

4.1 COORDINATION

- A. Coordinate installation of housekeeping concrete pad based on actual equipment supplied:
 - 1. Concrete: Per requirements in Division 03 – Concrete.
 - 2. Dimensions: Per requirements in Section 26 0529 – Hangers and Supports for Electrical Systems.
- B. Coordinate with miscellaneous trades for equipment foreign to the electrical installation to be outside of dedicated electrical space.
- C. Coordinate with Owner to arrange for Switchgear Manufacturer Field Services to perform scope after Switchboard is installed.

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 switchboard mounting meets code-required working clearances.
- C. Notify Architect/Engineer of any discrepancies prior to submittal of product data and shop drawings.

4.3 INSTALLATION

- A. Install switchboard in accordance with NEMA PB 2.1 and ANSI/NECA 400.
- B. Install engraved plastic nameplates under provisions of Section 26 0553 – Electrical Systems Identification for each switchboard, every instrument, overcurrent protective device and disconnect device. Attach nameplate to exterior of each switchboard using small corrosion-resistant metal screws and rivets. Do not use contact adhesive. Indicate switchboard name, amperage, voltage, phase, number of wires, short circuit current rating. For each overcurrent protective device and disconnect device, include load name.
- C. Install switchboards 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.

4.4 CONNECTIONS

- A. Ground switchboards 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 switchboards for physical damage, proper alignment, connections, anchorage, seismic restraints and grounding.

- B. Test continuity of each circuit.
- C. Test switchboards 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 ADJUSTING

- A. Set field-adjustable circuit breakers trip settings or change the trip settings to values indicated by coordination study provided by Designer.

4.8 CLEANING

- A. Vacuum dirt and construction debris from interior and exterior of equipment; do not use compressed air to assist in cleaning.

END OF SECTION

SECTION 26 2416.16

DISTRIBUTION PANELBOARDS

PART 1 - GENERAL

1.1 RELATED WORK – EQUIPMENT MANUFACTURER

- A. Drawing E.6.01

1.2 RELATED WORK – INSTALLING CONTRACTOR

- A. Section 26 0519 – Low-Voltage Electrical Power Conductors and Cables
- B. Section 26 0526 – Grounding and Bonding for Electrical Systems
- C. Section 26 0529 – Hangers and Supports for Electrical Systems
- D. Section 26 0553 – Electrical Systems Identification
- E. Section 26 0812 – Power Distribution Acceptance Tests
- F. Section 26 0813 – Power Distribution Acceptance Test Tables

1.3 REFERENCE

- A. Work under this Section is subject to requirements of Contract Documents including General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements.

1.4 DESCRIPTION

- A. Equipment shall be Owner Furnished, Contractor Installed (OFCI). Contractor shall be responsible with scheduling and coordination of installation of equipment with owner and equipment manufacturer. All cabling, conduit, and other work necessary to make operation shall be Contractor Furnished, Contractor Installed (CFCI).
- B. Section includes circuit breaker type power distribution panelboards as shown on drawings and as scheduled.
- C. This specification is for equipment identified on the drawings as follows:
 - 1. M1

1.5 REFERENCE STANDARDS

- A. NECA 407 - Recommended Practice for Installing and Maintaining Panelboards
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum)
- C. NEMA AB 1 - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit Breaker Enclosures
- D. NEMA FU 1 - Low-Voltage Cartridge Fuses
- E. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)
- F. NEMA PB 1 - Panelboards

- G. NEMA PB 1.1 - General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less
- H. NFPA 70 - National Electrical Code
- I. UL 50 - Enclosures for Electrical Equipment
- J. UL 67 - Panelboards
- K. UL 486A – 486B - Wire Connectors
- L. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit Breaker Enclosures
- M. UL 512 - Fuseholders
- N. UL 869A - Reference Standard for Service Equipment

1.6 SUBMITTALS

- A. Product Data:
 - 1. Submit catalog data showing specified features of standard products. Eliminate extraneous catalog data.
- B. Shop Drawings:
 - 1. Submit for review prior to manufacture. Include complete description, front view, dimensions, voltage, main bus ampacity, circuit breaker [fusible switch] arrangement and sizes, short circuit current rating, and factory settings of individual protective devices.
- C. Partial Submittals:
 - 1. Panelboards shall be submitted for review together. Partial submittals of panelboards are not acceptable and will be rejected.
- 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. Test Report:
 - 1. Indicate field test and inspection procedures and interpret test results and corrective action taken for compliance with specification requirements.
- F. Closeout Submittals:
 - 1. Project Record Documents:
 - a. Record actual locations of panelboards and record actual circuiting arrangements.
 - 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 time-current curves and selectable ranges for each type of overcurrent protective device.
 - d. Include spare parts data listing, source, and current prices of replacement parts and supplies.

- e. Include manufacturer's Seismic Qualification Certification and Installation Seismic Qualification Certification.

1.7 QUALITY ASSURANCE

- A. Obtain panelboards, overcurrent protective devices, components, and accessories from one source and by a single manufacturer.
- B. Regulatory Requirements:
 - 1. Comply with NFPA 70.
 - 2. Furnish products listed and classified by Underwriters Laboratories, Inc., as suitable for purpose specified and indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store in clean, dry space. Maintain factory wrapping or provide additional canvas or plastic cover to protect from dirt, water, construction debris, and traffic.
- B. Comply with NEMA PB 1.1 and manufacturer's written instructions.

1.9 WARRANTY

- A. Manufacturer shall provide standard 1 yr written warranty against defects in materials and workmanship for products specified in this Section. Warranty period shall begin on date of substantial completion.

1.10 MAINTENANCE

- A. Extra Materials:
 - 1. Furnish Owner with two keys per panelboard.
 - 2. Spare Breakers:
 - a. Provide line-Item pricing per spare breaker as bid alternate:
 - b. Spare breaker shall match features, functionality and trip unit as provided with the distribution panel board indicated by this specification as indicated in the drawings.
 - 1). 100 AF
 - 2). 150 AF
 - 3). 250 AF
 - 4). 400 AF

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. ABB
- B. Eaton
- C. Square D

2.2 POWER DISTRIBUTION PANELBOARDS

- A. NEMA PB 1, UL 67.
- B. Fabrication:
 - 1. Factory assembled

2. Individualized breaker dead-front cover with door-in-door construction.
 3. Incoming lugs: copper conductors
 - a. Main: Top Entry, (3-4) sets of 350-600kCMIL per phase and neutral.
 4. Multiple lugs to match number of conductors per phase
 5. Filler plates
 6. Wiring terminals for field installed conductors: Pressure wire connectors, except wire-binding screws for #10 AWG or smaller conductors.
- C. Panelboard Buses:
1. Copper
 2. Ampere rating as scheduled
 3. Ground bus: uninsulated, bonded to panelboard cabinet
 4. Insulated neutral bus where applicable: 100% of phase bus rating
- D. Molded-Case Circuit Breakers:
1. NEMA AB 1, UL 489
 2. Bolt-on or I-line type, labeled for 75°C copper and aluminum conductors
 3. Quick-make, quick-break, with thermal-magnetic trip and electronic (solid-state microprocessor-based) trip.
 4. Equipped with individually insulated, braced, and protected connectors
 5. Common internal trip on multi-pole breakers. Handle-ties are not permitted.
 6. Ampere rating as scheduled
 7. Front face flush with each other
 8. Large, permanent, individual circuit numbers affixed to each breaker in uniform position
 9. Tripped indication clearly shown by breaker handle taking position between "ON" and "OFF."
 10. Listed as Type HACR for air conditioning equipment circuits
 11. Bussing, device mounting hardware, and steel knockouts in dead front where "space" is indicated
 12. For 100A frame size and below: thermal-magnetic trip
 13. For 125A frame size and above: electronic trip units interchangeable in the field within the frame size and field-adjustable long time pick-up, long time delay, and instantaneous current settings as indicated on drawings.
 - a. Each adjustment shall have discrete settings and shall be independent of all other adjustments.
- E. Cabinet
1. NEMA 250, UL 50
 2. NEMA Type 1 enclosure.
 3. Refer to drawings for maximum dimensions.
 4. Four-piece front (trim) surface mounted with door over the front, with concealed self-adjusting trim clamps, and complete with cylinder-type lock.
 5. Boxes and fronts made of code-gauge galvanized steel
 6. Manufacturer's standard gray enamel finish over prime coat.

2.3 SHORT CIRCUIT CURRENT RATING

- A. Each panelboard with minimum short circuit current rating as indicated on drawings.
- B. Panelboards marked with their maximum short circuit current rating at supply voltage.

- C. Panelboards: Fully rated. Series-rated panelboards are not acceptable.

PART 3 - EXECUTION BY MANUFACTURER

3.1 COORDINATION

- A. Verify that “touch-up” paint kit is available for repainting.

PART 4 - EXECUTION BY INSTALLING CONTRACTOR

4.1 EXAMINATION

- A. Verify that space indicated for panelboard mounting meets code-required working clearances and dedicated equipment space.
- B. Notify Architect/Engineer of any discrepancies prior to submittal of product data and shop drawings.

4.2 INSTALLATION

- A. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.
- B. Install panelboards plumb and rigid without distortion of box, in accordance with manufacturer's written instructions, and in compliance with recognized industry practices.
- C. Panelboard mounting and seismic restraints:
 - 1. Fasten panelboards firmly to walls and structural surfaces, ensuring they are permanently and mechanically anchored.
 - 2. Anchor and fasten panelboards and their supports to building structural elements (wood, concrete, masonry, hollow walls and nonstructural building surfaces) by the methods described in Section 26 0529 – Hangers and Supports for Electrical Systems.
 - 3. Install two rows of steel slotted channel, with a minimum of four attachment points, for each panelboard section.
 - 4. When not located directly on wall, provide support frame of steel slotted channel anchored to floor and ceiling structure.
- D. Install top breaker handle a maximum of 2 m(6'-7") above finished floor or working platform, with handle in its highest position.
- E. Tighten electrical connectors and terminals according to equipment manufacturer's published torque tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A –486B.
- F. Install as-built typewritten circuit directory in directory frame (to indicate installed circuit loads before completing load balancing) mounted inside each panelboard door. Include description of connected loads, room number, room name, area, or item served for each branch circuit. Indicate motor names and horsepower as applicable. Cover circuit directory with colorless plastic. Coordinate with Owner and Architect to ensure that room numbers used in panel directory are final numbers assigned by Owner.
- G. Install engraved plastic nameplates under provisions of Section 26 0553 – Electrical Systems Identification. Attach nameplate to exterior of each panelboard using small, corrosion-resistant metal screws or rivets. Do not use contact adhesive.
 - 1. Indicate panelboard name, amperage, voltage, phase, and number of wires.

- H. Label spare circuits as SPARE. Leave spare breakers in OFF position.
- I. Room numbers used shall be those used by Owner except as otherwise directed by Architect.
- J. Install panelboard in dedicated electrical space per NFPA 70 and as shown on drawings. Coordinate with miscellaneous trades for equipment foreign to the electrical installation to be outside of dedicated electrical space.
- K. Install filler plates in unused spaces.

4.3 CONNECTIONS

- A. Ground panelboards according to Section 26 0526 – Grounding and Bonding for Electrical Systems.
- B. Connect wiring according to Section 26 0519 – Low-Voltage Electrical Power Conductors and Cables.

4.4 FIELD QUALITY CONTROL

- A. Inspect for physical damage, proper alignment, anchorage, and grounding.
- B. Test circuit breakers per requirements in Sections 26 0812 – Power Distribution Acceptance Tests and 26 0813 – Power Distribution Acceptance Test Tables.
- C. Interpret test results in writing and submit to Engineer.
- D. Check phase-to-phase and phase-to-ground insulation resistance levels prior to energizing panelboards.
- E. Check panelboards for electrical continuity of circuits and for short-circuits prior to energizing.

4.5 REPAINTING

- A. Remove paint splatters or other marks from surface of panelboards.
- B. Touch-up chips, scratches, or marred finishes to match original finish, using manufacturer-supplied paint kit. Leave remaining paint to Owner.

4.6 ADJUSTING

- A. Adjust fronts, covers, hinges, and locks.
- B. Set field-adjustable circuit breakers trip settings or change the trip settings to values indicated by coordination study provided by Designer.

4.7 CLEANING

- A. Clean panelboard interiors and exteriors prior to final inspection. Remove paint splatters and other spots, dirt and debris.

END OF SECTION

SECTION 26 2713

ELECTRICAL METERING

PART 1 - GENERAL

1.1 RELATED WORK – EQUIPMENT MANUFACTURER

- A. Section 26 2416.16 – Distribution Panelboards

1.2 RELATED WORK – INSTALLING CONTRACTOR

- A. Section 26 0812 - Power Distribution Acceptance Tests
- B. Section 26 0813 - Power Distribution Acceptance Test Tables

1.3 DESCRIPTION

- A. Section includes equipment for energy and demand metering by Owner.
- B. This equipment shall be Owner Furnished, Contractor Installed (OFCI) as part of specification 26 2413 – Switchboards. Contractor shall be responsible with scheduling and coordination of installation of equipment with owner and equipment manufacturer. All cabling, conduit, and other work necessary to make operation shall be Contractor Furnished, Contractor Installed (CFCI).
 - 1. Equipment provided by Switchgear manufacturer shall include instrumentation, shorting blocks, fuse blocks, etc for meters mounted external from switchboard. Meter and external enclosure shall be Owner Furnished, Contractor Installed (OFCI).

1.4 REFERENCE STANDARDS

ANSI C12.1 – Code for Electricity Metering

- A. ANSI C12.10 – Watthour Meters
- B. ANSI C12.11 – Instrument Transformers for Revenue Metering, 10 kV BIL Through 350 kV BIL (0.6 kV NSV Through 69 kV NSV)
- C. ANSI C12.18 – Protocol Specification for ANSI Type 2 Optical Port
- D. ANSI C12.19 – Utility Industry End Device Data Tables
- E. ANSI C12.20 – Electricity Meters-0.2 and 0.5 Accuracy Classes
- F. ANSI C39.1 – Requirements, Electrical Analog Indicating Instruments
- G. IEEE C37.90.1 – Standard Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus
- H. IEEE C57.13 – Standard Requirements for Instrument Transformers
- I. IEEE C62.11 – Metal-Oxide Surge Arresters for Alternating Current Power Circuits
- J. IEEE C62.41.1 – Guide on the Surge Environment in Low-Voltage (1000 V and less) AC Power Circuits
- K. IEEE C62.41.2 – Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits

- L. IEEE C62.45 – Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits
- M. NECA 1 – Standard Practices for Good Workmanship in Electrical Contracting
- N. NECA 400 – Recommended Practice for Installing and Maintaining Switchboards
- O. NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum)
- P. NEMA AB 1 – Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit Breaker Enclosures
- Q. NEMA AB 3 – Molded-Case Circuit Breakers and Their Applications
- R. NEMA EI 21.1 – Instrument Transformers for Revenue Metering (110KV BIL and Less)
- S. NEMA KS 1 – Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)
- T. NEMA LA 1 – Surge Arresters
- U. NEMA PB 2 – Dead-Front Distribution Switchboard
- V. NFPA 70 – National Electrical Code
- W. UL 50 – Standard for Enclosures for Electrical Equipment (1995)
- X. UL 98 – Enclosed and Dead-Front Switches
- Y. UL 467 – Grounding and Bonding Equipment
- Z. UL 486A-486B – Wire Connectors
- AA. UL 489 – Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit Breaker Enclosures
- BB. UL 891 – Dead-Front Switchboards
- CC. ASTM D1535 – Standard Practice for Specifying Color by the Munsell System

1.5 SUBMITTALS

- A. Product Data: For metering equipment, components and accessories indicated:
 - 1. Include data on features, components, and complete description; submit catalog cut sheets showing electrical characteristics and ratings.
 - 2. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes. Describe operating sequences, both automatic and manual.
- B. Shop Drawings:
 - 1. Dimensioned plans and sections or elevation layouts.
 - 2. Wiring Diagrams: Power, signal, and control wiring. Identify terminals and wiring designations and color codes to facilitate installation, operation, and maintenance. Indicate recommended types, wire sizes, and circuiting arrangements for field installed wiring, and show circuit protection features.
- C. 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.

- D. Test Reports: Indicate field test and inspection procedures and interpret test results and corrective action taken for compliance with specification requirements.
- E. Closeout Submittals:
 - 1. Project Record Documents:
 - a. Record actual locations and ratings of metering equipment 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.
 - b. Include manufacturer's written instructions for testing.
 - c. Include spare parts data listing, source, and current prices of replacement parts and supplies.
 - d. Include manufacturer's Seismic Qualification Certification and Installation Seismic Qualification Certification.

1.6 QUALITY ASSURANCE

- A. Obtain metering equipment 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 Underwriters Laboratories, Inc., as suitable for purpose specified and indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Receive, store, and handle modular meter center as specified in NECA 400. Use factory installed lifting provisions. Handle carefully to avoid damage to assembly internal components, enclosure, and finish.

1.8 WARRANTY

- A. Refer to Division 01 and Section 26 0000 – General Electrical Requirements for general warranty requirements.
- B. Manufacturer shall provide standard 1 yr warranty against defects in materials and workmanship for products specified in this Section. Warranty period shall begin on date of substantial completion.

1.9 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 2 of each size and type.
 - 2. Control-Power Fuses: Equal to 10% of amount installed for each size and type, minimum of 2 of each size and type.
 - 3. Fuses for Fused Switches: Equal to 10% of amount installed for each size and type, minimum of 3 of each size and type.

PART 2 - PRODUCTS

2.1 EQUIPMENT FOR ELECTRICAL METERING BY OWNER

- A. Multifunction Digital-Metering Monitor: Not Applicable, furnished separately by Owner.
- B. Instrumentation:
 - 1. Manufacturers:
 - a. ABB
 - b. Eaton
 - c. Square D
 - 2. Instrument Transformers: NEMA EI 21.1, IEEE C57.13, and the following:
 - a. Potential Transformers: Secondary voltage rating of 120 V and NEMA accuracy class of 0.3 with burdens of W, X, and Y.
 - 1). 600 V and below: external PTs not required; fused potential connection.
 - b. Current Transformers: Bar or Window type; ratios shall be as indicated with accuracy class and burden suitable for connected relays, meters, and instruments; shorting test blocks: 10 poles – 4 potential and 6 current, mounted with meter or in accessible location.
 - c. Control-Power Transformers: Dry type, mounted in separate compartments for units larger than 3 kV.
 - d. Current Transformers for Neutral and Ground-Fault Current Sensing: Connect secondaries to ground overcurrent relays to provide selective tripping of main and tie circuit breaker. Coordinate with feeder circuit breaker ground-fault protection.

PART 3 - EXECUTION BY INSTALLING CONTRACTOR

3.1 METER INTEGRATION

- A. Owner shall integrate each meter into Owner's existing Schneider PME software.

3.2 INSTALLATION

- A. 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.

3.3 FIELD QUALITY CONTROL

- A. Test continuity of each circuit.
- B. Test metering equipment per requirements in Sections 26 0812 – Power Distribution Acceptance Tests and 26 0813 – Power Distribution Acceptance Test Tables.
- C. Interpret test results in writing and submit to Engineer.

3.4 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.

3.5 CLEANING

- A. Vacuum dirt and construction debris from interior and exterior of equipment; do not use compressed air to assist in cleaning.

END OF SECTION

SECTION 26 4300

SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 RELATED WORK

- A. Section 26 2413 – Switchboards

1.2 DESCRIPTION

- A. This equipment shall be Owner Furnished, Contractor Installed (OFCI) as part of specification 26 2413 – Switchboards. Contractor shall be responsible with scheduling and coordination of installation of equipment with owner and equipment manufacturer. All cabling, conduit, and other work necessary to make operation shall be Contractor Furnished, Contractor Installed (CFCI).
- B. Provide Type 1 Surge Protective Devices (SPD) for the protection of AC electrical circuits formerly known as Transient Voltage Surge Suppression (TVSS) System. Provide high energy surge current diversion and be suitable for application in Type 1 environments.
- C. Modes of Protection:
 - 1. Line to Ground, Line to Neutral and Neutral to Ground for services with a neutral
 - 2. For Services without a neutral, Line to Line and Line to Ground
- D. Provide common and normal modes of protection.

1.3 REFERENCE STANDARDS

- A. ANSI/UL 1449 Surge Protective Devices Third Edition or Newer
- B. IEEE 587
- C. FIPS PUB 94
- D. IEEE C62.11 – Standard for Metal-Oxide Surge Arresters for Alternating Current Power Circuits (> 1 kV)
- E. IEEE C62.41.1 Guide on the Surges Environment in Low-Voltage (1000 V and Less) AC Power Circuits
- F. IEEE C62.41.2 Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits
- G. IEEE C62.45 IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and less) AC Power Circuits
- H. IEEE C62.62 IEEE Standard Test Specifications for Surge Protective Devices (SPDs) for Use on the Load Side of the Service Equipment in Low Voltage (1000V and less) AC Power Circuits
- I. National Electrical Code – Article 285
- J. NEMA LA 1 – Surge Arresters
- K. National Fire Protection Association – NFPA 20, 70, 75, and 780

- L. UL 96A Installation Requirements for Lightning Protection Systems

1.4 SUBMITTALS

- A. Submit Shop Drawings for equipment provided under this Section.
- B. Submit shop drawings and product information for approval and final documentation in quantities listed according to Conditions of the Contract. Identify customer name, customer location, and customer order number.
- C. Submit ANSI/UL 1449 Listing documentation to indicate the following:
 - 1. Short Circuit Current Rating (SCCR)
 - 2. Voltage Protection Ratings (VPRs) for all modes
 - 3. Maximum Continuous Operating Voltage rating (MCOV)
 - 4. Nominal Discharge Current rating (I-n)
 - 5. Type 1 device
 - 6. VPR, MCOV, I-n, and Type 1 information is posted at www.UL.com under Certifications; search using UL Category Code: VZCA. SCCR's are posted in manufacturer's published documentation.
 - 7. UL data and visual inspection takes precedence over manufacturer's published documentation.
- D. Provide shop drawings including manufacturer installation instruction manual and line drawings detailing dimensions and weight of enclosure, internal wiring diagram illustrating all modes of protection in each type of SPD required, wiring diagram showing field connections, and manufacturer's recommended wire and breaker sizes (if required).
- E. Upon request, modules using encapsulation shall be presented without encapsulation for visual inspection, proprietary technology included. MOV type and quantity shall reflect kA ratings on cutsheets, verification of diagnostic monitoring, thermal and overcurrent protection, etc.

PART 2 - PRODUCTS

2.1 MATERIAL

- A. Acceptable manufacturers:
 - 1. Disconnect Manufacturer - Internally mounted unit within Disconnect

2.2 PERFORMANCE CHARACTERISTICS

- A. SPD shall bear the UL Mark and shall be Listed to Third Edition of ANSI/UL 1449. "Manufactured in accordance with" is not equivalent to UL Listing and does not meet intent of specification.
- B. Post SPD and performance parameters at www.UL.com under Category Code: VZCA. Products or parameter without posting at UL.com are not approved.
- C. Minimum surge current capacity for Service Entrance units based on 8 x 20 microsecond current waveform:
 - 1. 200,000 A between each phase for line-to-line mode
 - 2. 200,000 A each phase for line-to-ground mode
 - 3. 200,000 A each phase for line-to-neutral mode
 - 4. 200,000 A for neutral-to-ground mode
- D. Sequential Surge Current Survivability:

1. 1,000 sequential category surges without failure.
- E. Current Rating:
1. Rated for continuous current and AIC rating of equipment protected.
 2. Mark SPD Short-Circuit Current Rating on the SPD label.

2.3 OPERATING CONDITIONS

- A. Temperature range: -40°F to 122°F
- B. Relative humidity range: 0 to 95%, non-condensing
- C. Audible noise level: > 40 dBA at 5 ft
- D. SPD Surface Temperature: less than 131°F

2.4 FABRICATION

- A. SPD Modules:
1. UL Labeled as Type 1 (verifiable at www.UL.com), intended for use without need for external or supplemental overcurrent controls. Protect suppression component of every mode, including N-G, by internal overcurrent and thermal overtemperature controls. SPDs relying on external or supplementary installed safety disconnects do not meet intent of specification.
 2. Suppression components: Heavy-duty MOVs, selenium cells, or combination of both.
 3. Provide surge current diversion paths for all modes of protection: L-N, L-G, N-G in WYE systems, and L-L, L-G in DELTA systems.
 4. Provide service entrance SPD audible diagnostic monitoring by way of audible alarm.
 5. Provide service entrance SPD with 1 set of NO/NC dry contacts for alarm conditions.
 6. Provide visual LED diagnostics including a minimum of 1 green LED indicator per phase, and 1 red service LED. Include an audible alarm with on/off silence function and diagnostic test function (excluding branch).
 7. The disconnect itself shall serve as a means to disconnect the SPD.
 8. Meet or exceed the following criteria:
 - a. ANSI/UL 1449 Listed Voltage Protection Ratings (VPRs) for 6kV 3000A testing as follows:

VOLTAGE	L-N L-G N-G	L-L
208Y/120V	≤800V	≤1200V
480Y/277V	≤1200V	≤2000V

9. ANSI/UL 1449 Listed Maximum Continuous Operating Voltage (MCOV) (verifiable at UL.com):

System Voltage	Allowable System Voltage Fluctuation (%)	MCOV
208Y/120	15%	150V
480Y/277	15%	350V

10. Provide serviceable, replaceable modules (excluding Branch).
 11. Provide warranty for a period of 10 yrs, incorporating unlimited replacements of suppressor parts if they are destroyed by transients during the warranty period.
 12. Provide SPD with digital surge event counter with capacitor backup.
- B. Service Entrance:
1. Install 1 primary suppressor to the service entrance in accordance with manufacturer instructions.
 2. Install SPD on load side.
 3. Bond SPD ground to service entrance ground.
- C. SPD Low-Impedance Interconnect Cable:
1. Provide low-impedance cable specifically listed for SPD installations.
 2. Low impedance approximately 25% of conventional pipe and wire for improved clamping voltage.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install per manufacturer's recommended practices.
- B. Provide short and straight conductors not exceeding 3 ft in length. Manufacturer-approved cables may be used that allow conductor length to extend beyond 3 ft in length without affecting capability of unit.
- C. Input conductors twisted together to reduce inductance.
- D. Avoid 90-degree bends in cable.

3.2 QUALITY ASSURANCE

- A. Factory test system before shipment. Include quality control check, "Hi-Pot" tests at 2 times rated voltage plus 1,000 V, ground leakage tests, and calibration.
- B. Manufacturer Qualifications: Engage a firm with at least 5 yrs experience in manufacturing surge protective devices.
- C. Manufacturer of equipment shall have produced similar electrical equipment for a minimum period of 5 yrs. When requested by Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with requirement.
- D. Provide SPD compliant with the Restriction of Hazardous Substances (RoHS) Directive 2002/95/EC.

3.3 FIELD QUALITY CONTROL

- A. Inspections before SPD startup:
1. Visual Inspection:
 - a. Verify installation per drawings.
 - b. Verify phase, neutral, and ground conductors are properly sized and configured.
 2. Mechanical Inspection:
 - a. Check connections for tightness.
 - b. Check terminal screws, nuts and/or connectors for tightness.

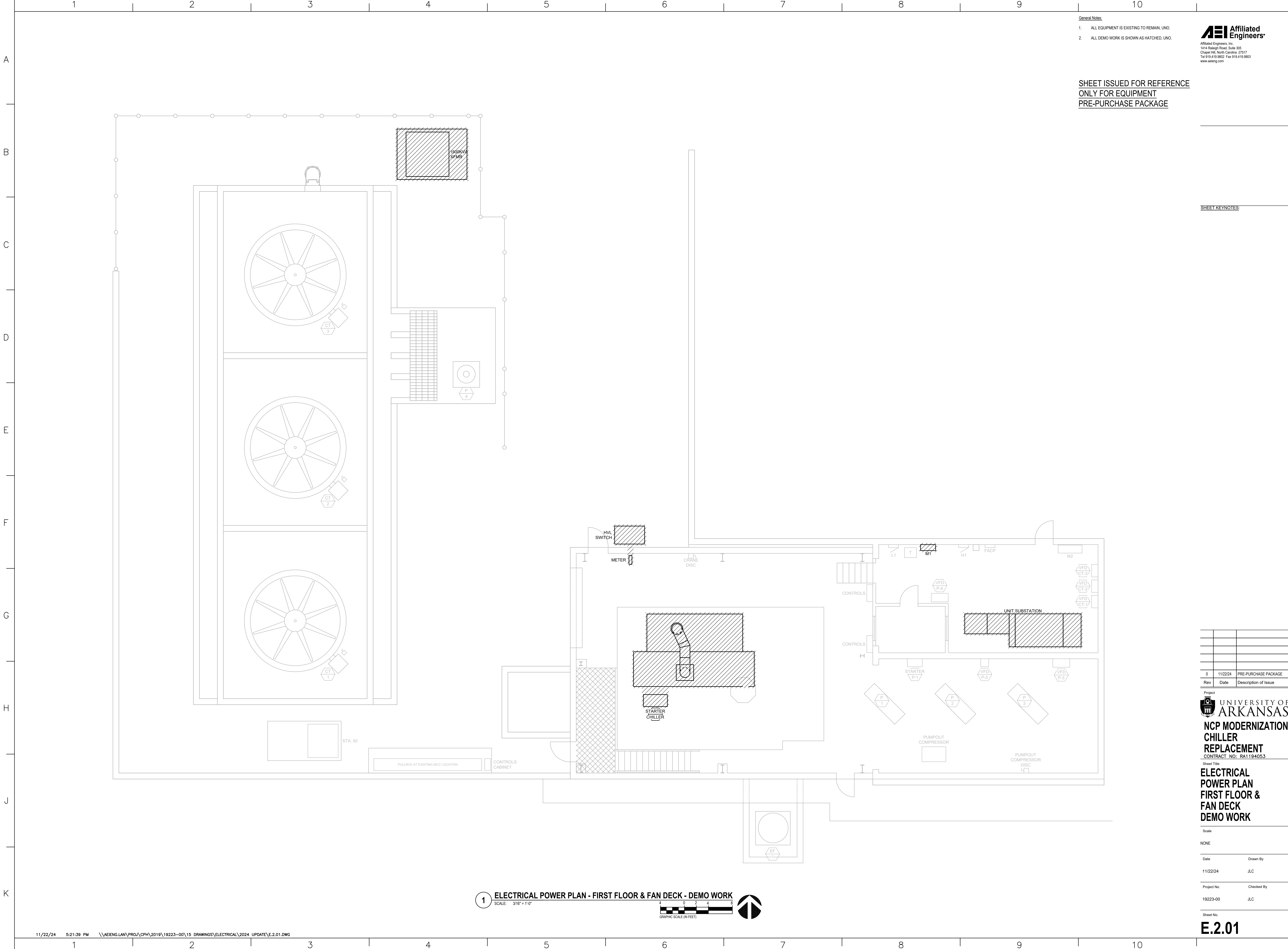
3. Electrical Inspection:

- a. Confirm input voltage.
- b. Confirm phase, neutral and ground connections are proper.

3.4 WARRANTY

- A. Provide 10 yr manufacturer warranty.

END OF SECTION



- General Notes:
1. ALL EQUIPMENT IS EXISTING TO REMAIN, UNO.
 2. ALL DEMO WORK IS SHOWN AS HATCHED, UNO.

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SHEET KEYNOTES:

Rev	Date	Description of Issue
0	11/22/24	PRE-PURCHASE PACKAGE

Project
UNIVERSITY OF ARKANSAS
NCP MODERNIZATION
CHILLER
REPLACEMENT
CONTRACT NO: RA1194053

Sheet Title
ELECTRICAL
POWER PLAN
FIRST FLOOR &
FAN DECK
DEMO WORK

Scale
NONE

Date
11/22/24

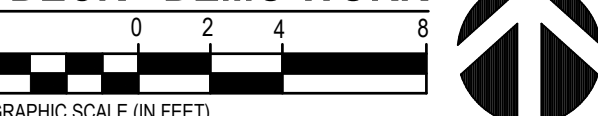
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JLC

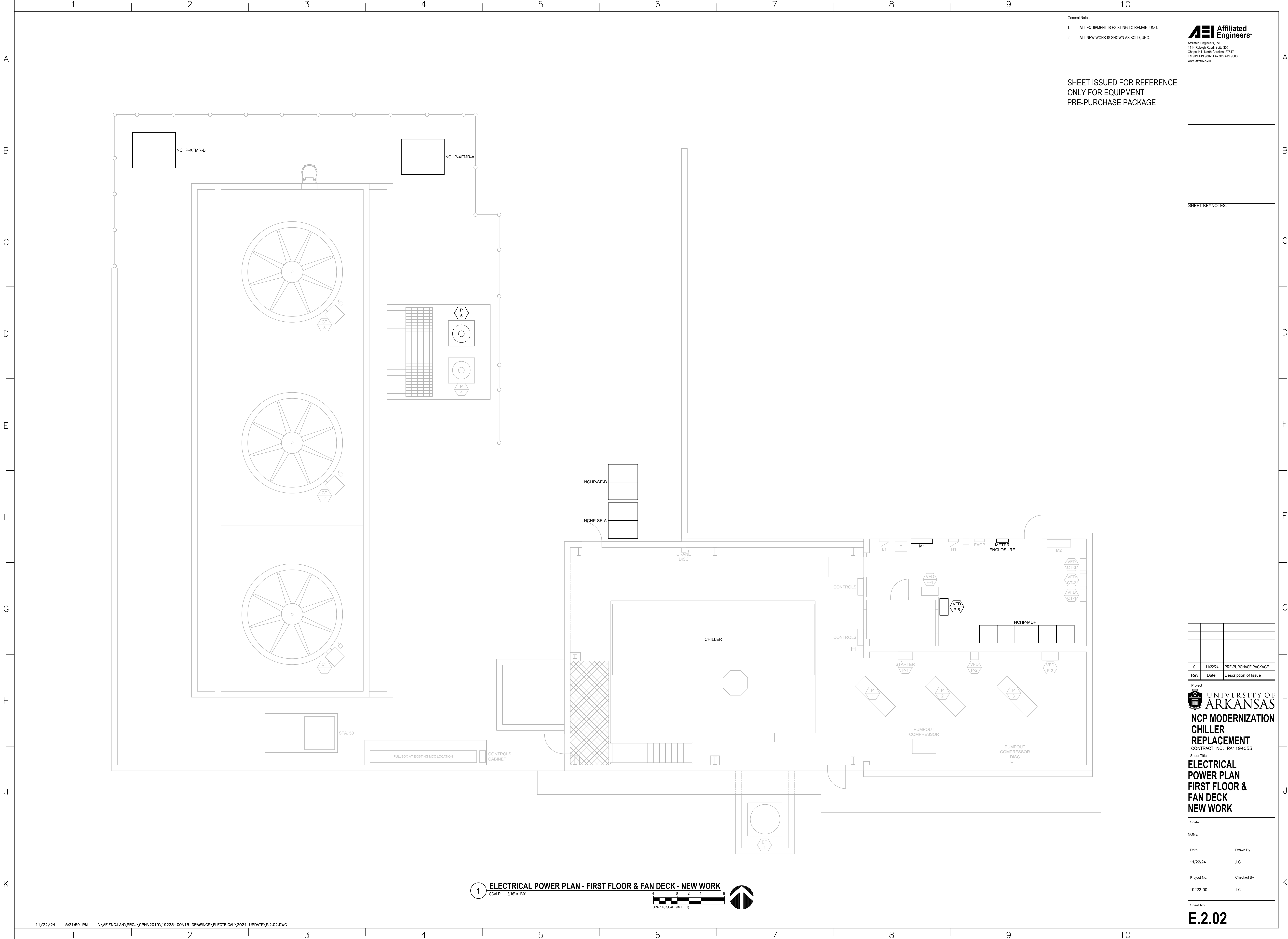
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19223-00

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JLC

Sheet No.
E.2.01

1 ELECTRICAL POWER PLAN - FIRST FLOOR & FAN DECK - DEMO WORK
SCALE: 3/16" = 1'-0"





- General Notes:
1. ALL EQUIPMENT IS EXISTING TO REMAIN, UNO.
 2. ALL NEW WORK IS SHOWN AS BOLD, UNO.

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UNIVERSITY OF ARKANSAS
NCP MODERNIZATION
CHILLER REPLACEMENT
CONTRACT NO: RA1194053

Sheet Title
**ELECTRICAL POWER PLAN
FIRST FLOOR &
FAN DECK
NEW WORK**

Scale

NONE

Date
11/22/24

Drawn By
JLC

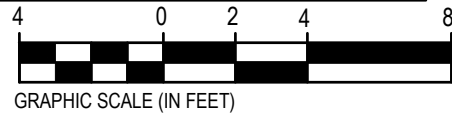
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19223-00

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JLC

Sheet No.

E.2.02

1 ELECTRICAL POWER PLAN - FIRST FLOOR & FAN DECK - NEW WORK
SCALE: 3/16" = 1'-0"



A
B
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General Notes:

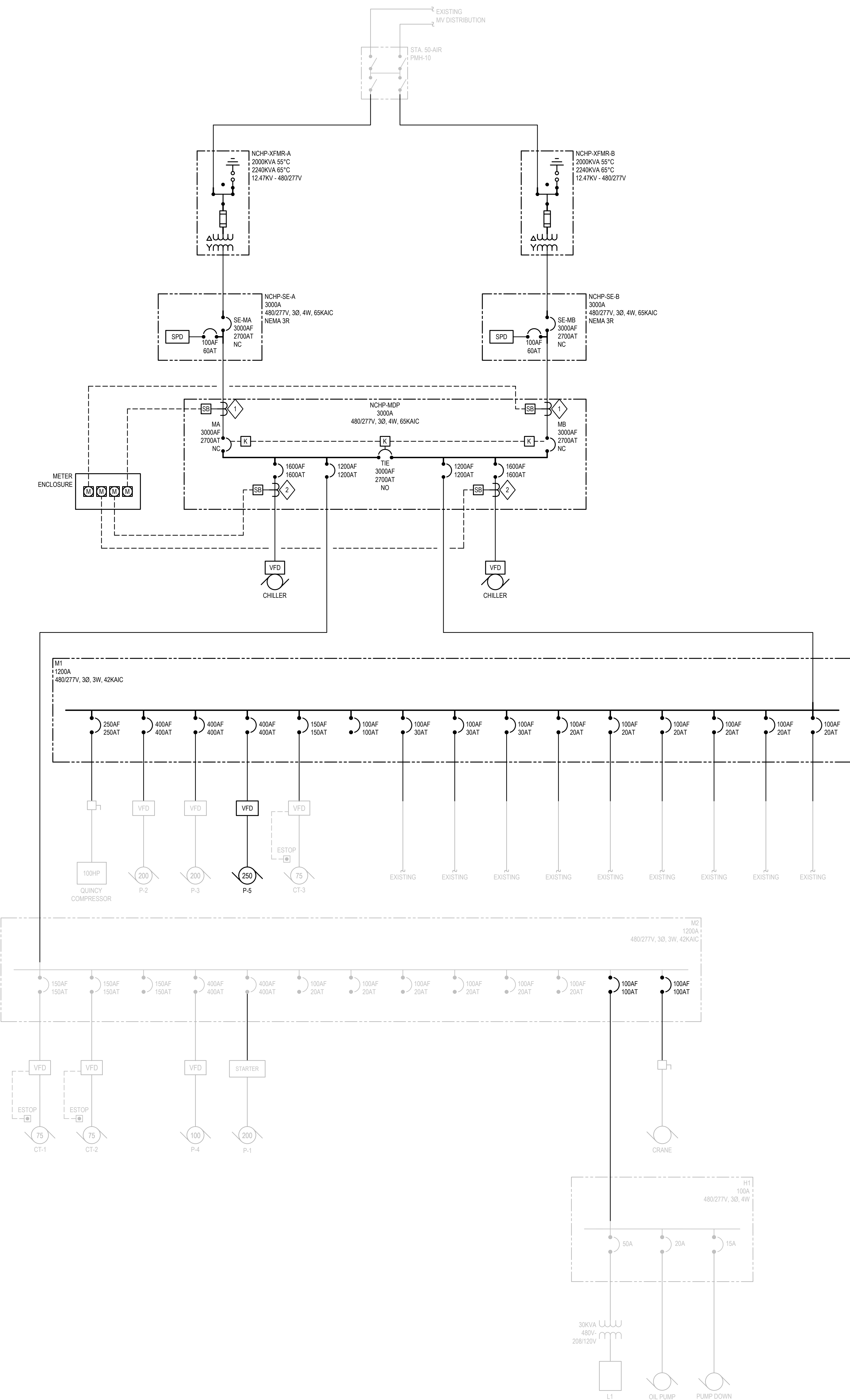
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2. ALL DEMO WORK IS SHOWN AS HATCHED, UNO.
3. ALL NEW WORK IS SHOWN AS BOLD, UNO.



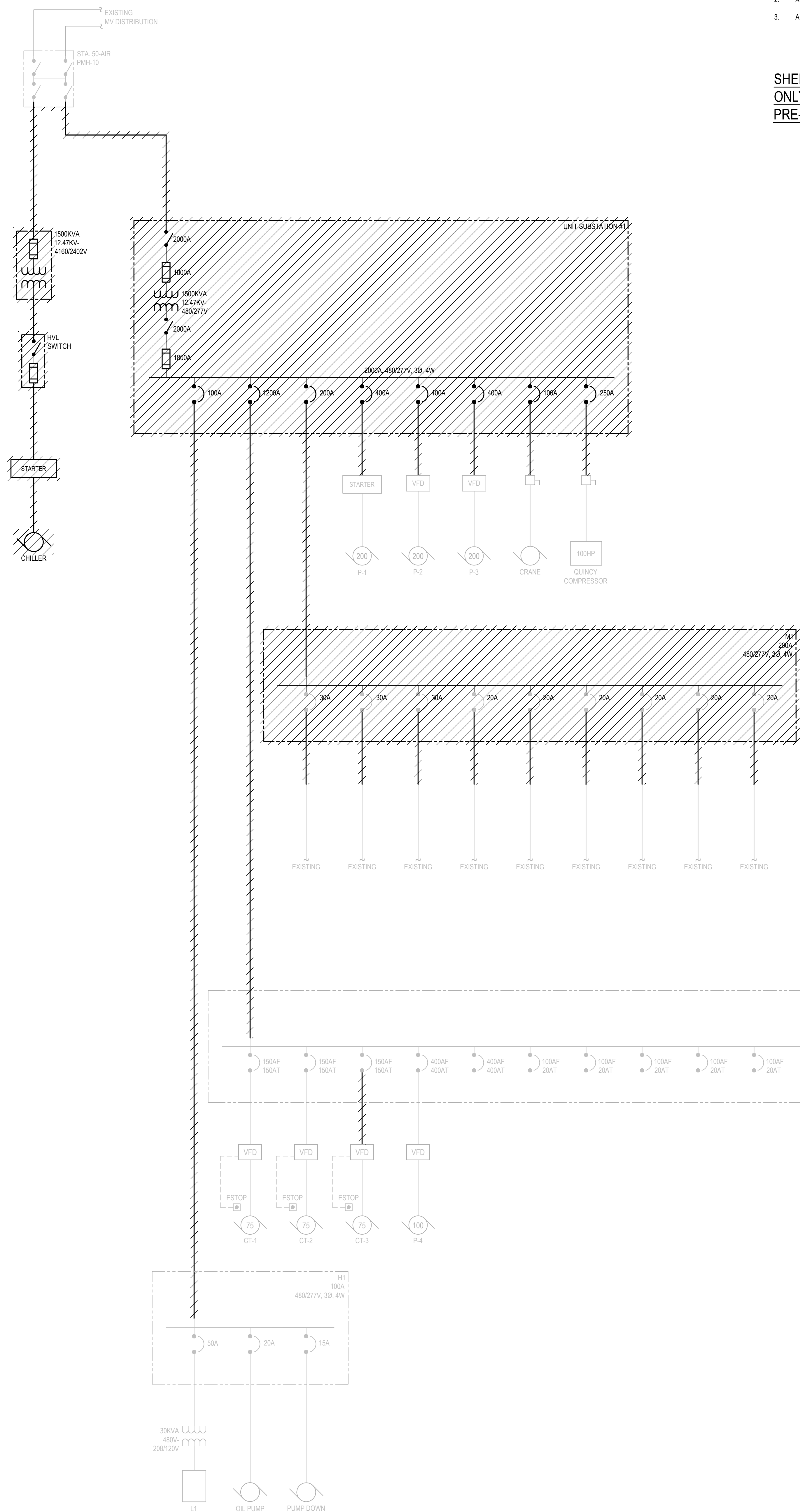
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ONLY FOR EQUIPMENT
PRE-PURCHASE PACKAGE**

SHEET KEYNOTES:

- 1 PROVIDE FUSE BLOCK CONNECTED TO LINESIDE BUS FOR 3-PHASE VOLTAGE CONNECTION. VOLTAGE WIRING ROUTED TO EXTERNAL METER WITH CT WIRING.
- 2 PROVIDE FUSE BLOCK CONNECTED TO THE SAME SWITCHBOARD BUS SERVING THE CIRCUIT BREAKER FOR 3-PHASE VOLTAGE CONNECTION. VOLTAGE WIRING ROUTED TO EXTERNAL METER WITH CT WIRING.



2 ELECTRICAL SINGLE LINE DIAGRAM - NEW WORK
SCALE: NOT TO SCALE



1 ELECTRICAL SINGLE LINE DIAGRAM - DEMO WORK
SCALE: NOT TO SCALE

Rev	Date	Description of Issue
0	11/22/24	PRE-PURCHASE PACKAGE

Project
UNIVERSITY OF ARKANSAS
NCP MODERNIZATION
CHILLER REPLACEMENT
CONTRACT NO: RA1194053

Sheet Title
ELECTRICAL SINGLE LINE DIAGRAM
DEMO & NEW WORK

Scale	NONE
Date	11/22/24
Drawn By	JLC
Project No.	19223-00
Checked By	JLC

Sheet No.

E.4.01

DISTRIBUTION PANEL SCHEDULE

M1

Bus Rating:	1200A	Volt:	480Y/277	KAIC Rating:	42	Location:	Main Elec Rm
Main Circuit Breaker:	MLO	Phase:	3	Wire:	4	Nema Rating:	1
Mounting:	Surface						
Remarks - Top Entry Incoming Cables, Top Entry Outgoing Feeder Cables							

Cat. No.	Description	Circuit Breaker Description			Load Type	Connected Load (KVA)	Demand Load (KVA)
		Pole	Frame	Tripping	Func		
A	AIR COMPRESSOR	3	250	250	LSI	M	103.1
B	P-2	3	400	400	LSI	M	199.5
C	P-3	3	400	400	LSI	M	199.5
D	P-5	3	400	400	LSI	M	251.1
E	CT-3	3	150	150	LI	M	79.8
1	SPARE	3	100	100		G	0.0
2	EXISTING	3	100	30		G	8.3
3	EXISTING	3	100	30		G	8.3
4	EXISTING	3	100	30		G	8.3
5	EXISTING	3	100	20		G	6.7
6	EXISTING	3	100	20		G	6.7
7	EXISTING	3	100	20		G	6.7
8	EXISTING	3	100	20		G	6.7
9	EXISTING	3	100	20		G	6.7
10	EXISTING	3	100	20		G	6.7

Circuit Breaker Functional Trip Option:

LI = Long-Instantaneous Settings
LSI = Long-Short-Instantaneous Settings
LSIG = Long-Short-Instantaneous-Ground Fault Settings
LSIA = Long-Short-Instantaneous-Ground Fault Alarm Settings

Total Connected Load, KVA

897.9
Total Connected Load, Amps 1080.0
Total Demand Load, KVA 910.4
Total Demand Load, Amps 1095.1

Load Type Legend

R = Receptacle
L = Lighting
M = Motor
G = General

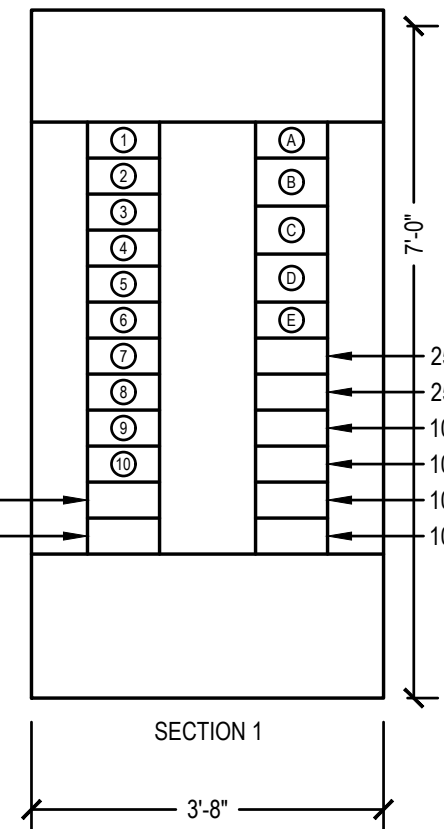
Circuit Breaker Option Legend

ST = Shunt Trip
BL = Breaker Lock
GF = GFCI (5mA)
EG = Equipment Ground (30mA)

FR = 100% Rated

AF = Arc Fault

K = Key Interlock



4 ELECTRICAL EQUIPMENT ELEVATION & SCHEDULE - M1

SCALE: NOT TO SCALE

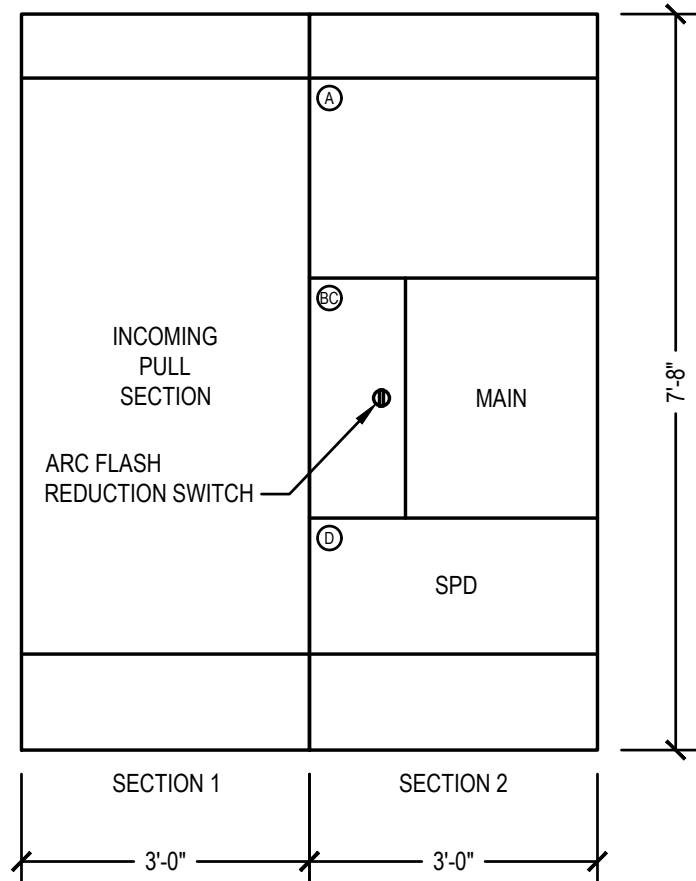
SWITCHBOARD SCHEDULE

Location:	Exterior
Rear Accessible:	No
Bus Rating:	3000A
Voltage:	480Y/277
Phase:	3
Wire:	4
Remarks - Service Entrance Rated	

Main Circuit Breaker - SE-MA	
Frame Rating:	3000A
Plug Rating:	3000A
Trip Rating:	2700A
Breaker Type:	IC
Functional Trip:	LSIG
Breaker Option 1:	AFR
Breaker Option 2:	MTU
Breaker Option 3:	

Remarks - 100% Rated Breaker

	KVA	Amps
Connected Load	1715.1	2063.0
Demand Load	1976.8	2377.8



1 ELECTRICAL EQUIPMENT ELEVATION & SCHEDULE - NCHP-SE-A

SCALE: NOT TO SCALE

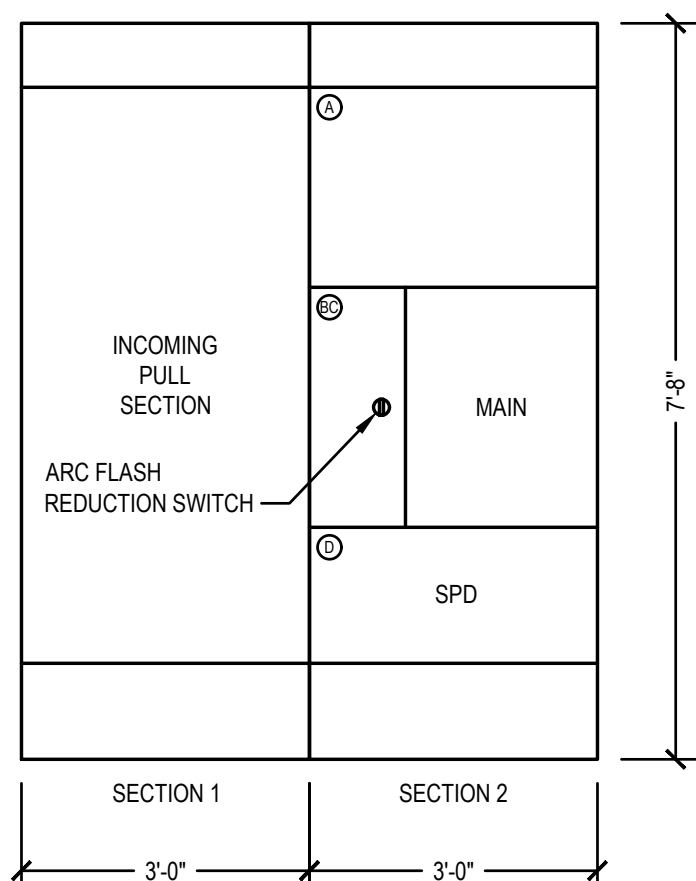
SWITCHBOARD SCHEDULE

Location:	Exterior
Rear Accessible:	No
Bus Rating:	3000A
Voltage:	480Y/277
Phase:	3
Wire:	4
Remarks - Service Entrance Rated	

Main Circuit Breaker - SE-MB	
Frame Rating:	3000A
Plug Rating:	3000A
Trip Rating:	2700A
Breaker Type:	IC
Functional Trip:	LSIG
Breaker Option 1:	AFR
Breaker Option 2:	MTU
Breaker Option 3:	

Remarks - 100% Rated Breaker

	KVA	Amps
Connected Load	1715.1	2063.0
Demand Load	1976.8	2377.8



2 ELECTRICAL EQUIPMENT ELEVATION & SCHEDULE - NCHP-SE-B

SCALE: NOT TO SCALE

SWITCHBOARD SCHEDULE

Location:	Main Elec Rm
Rear Accessible:	No
Bus Rating:	3000A
Voltage:	480Y/277
Phase:	3
Wire:	4
Remarks -	

Main Circuit Breaker - MA	
Frame Rating:	3000A
Plug Rating:	3000A
Trip Rating:	2700A
Breaker Type:	IC
Functional Trip:	LSIG
Breaker Option 1:	AFR
Breaker Option 2:	MT
Breaker Option 3:	K

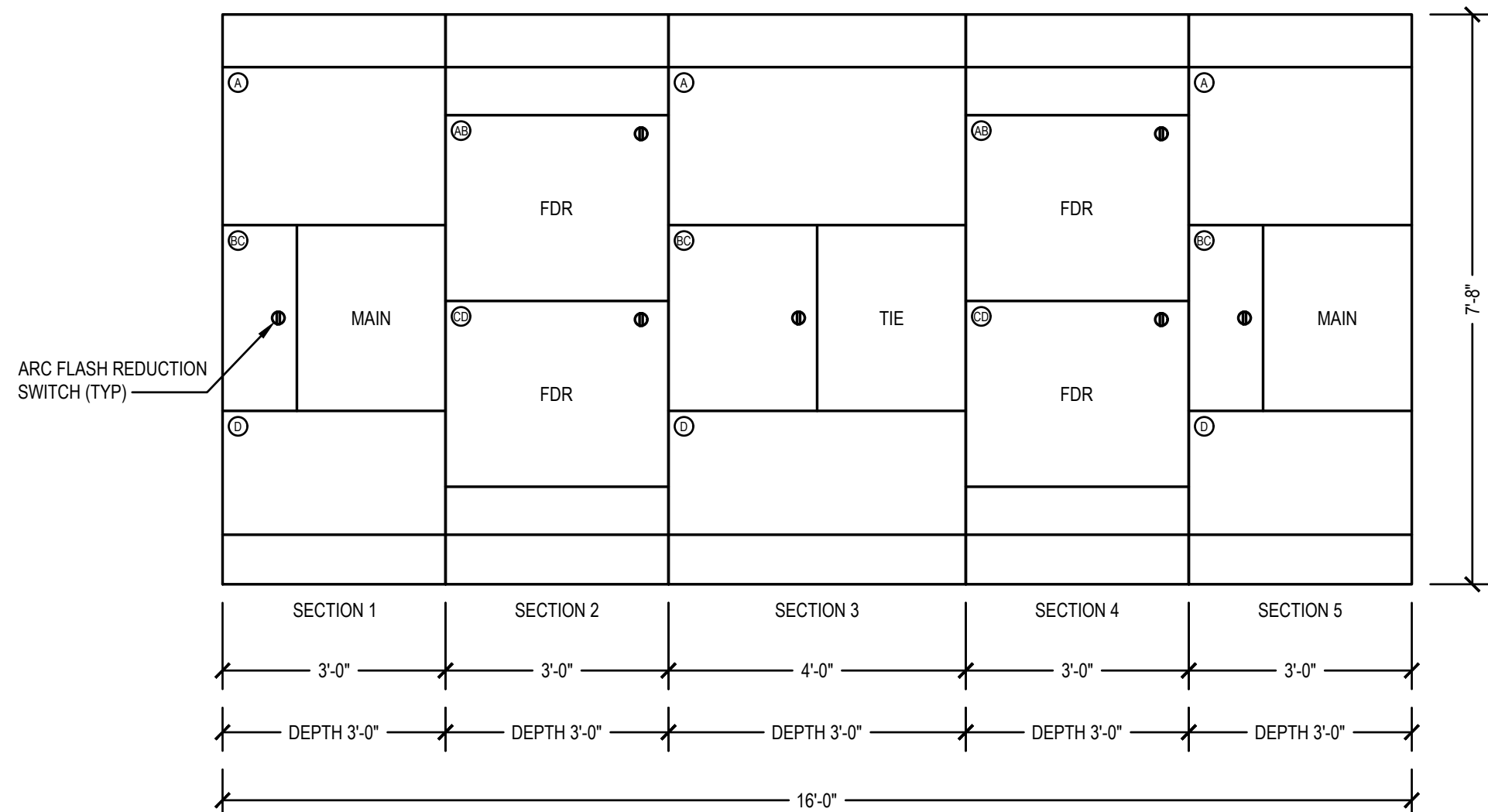
Remarks - 100% Rated Breaker, NOTE 3

	KVA	Amps
Left Side Connected Load	1715.1	2063.0
Left Side Demand Load	1976.8	2377.8

Main Circuit Breaker - MB	
Frame Rating:	3000A
Plug Rating:	3000A
Trip Rating:	2700A
Breaker Type:	IC
Functional Trip:	LSIG
Breaker Option 1:	AFR
Breaker Option 2:	MT
Breaker Option 3:	K

Remarks - 100% Rated Breaker, NOTE 3

	KVA	Amps
Right Side Connected Load	1944.6	2339.0
Right Side Demand Load	2206.3	2653.8



3 ELECTRICAL EQUIPMENT ELEVATION & SCHEDULE - NCHP-MDP

SCALE: NOT TO SCALE

NCHP-SE-A

Sect. No.	Unit No.	Description	Circuit Breaker Description			Connected Load (KVA)	Demand Load (KVA)	Comments
			Pole	Frame	Plug			
1	A	INCOMING LUGS						BUSSED SECTION

2	D	SPD	3	100	100	60	MC	
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Notes:

- Bottom Entry Incoming Cables, Bottom Entry Outgoing Cables
-

TYPE

PB = Power Breaker
IC = Insulated Case Breaker
MC = Fixed Molded Case Breaker

Circuit Breaker Functional Trip Option:

LI = Long-Instantaneous Settings
LSI = Long-Short-Instantaneous Settings
LSIG = Long-Short-Instantaneous-Ground Fault Settings
LSIA = Long-Short-Instantaneous-Ground Fault Alarm Settings

Circuit Breaker Option Legend

AFR = Arc Flash Reduction Mode
BL = Breaker Lock
EO = Electrically Operated
FR = 100%
K = Key Interlock
MT = Meter
MTU = Meter Integral to Trip Unit
SPD = Surge Protective Device
ST = Shunt Trip

SHEET KEYNOTES:

NCHP-SE-B

Sect. No.	Unit No.	Description	Circuit Breaker Description			Connected Load (KVA)	Demand Load (KVA)	Comments
			Pole	Frame	Plug			
1	A	INCOMING LUGS						BUSSED SECTION

2	D	SPD	3	100	100	60	MC	
---	---	-----	---	-----	-----	----	----	--

Notes:

- Bottom Entry Incoming Cables, Bottom Entry Outgoing Cables
-

TYPE

PB = Power Breaker
IC = Insulated Case Breaker
MC = Fixed Molded Case Breaker

Circuit Breaker Functional Trip Option:

LI = Long-Instantaneous Settings
LSI = Long-Short-Instantaneous Settings
LSIG = Long-Short-Instantaneous-Ground Fault Settings
LSIA = Long-Short-Instantaneous-Ground Fault Alarm Settings

Circuit Breaker Option Legend

AFR = Arc Flash Reduction Mode
BL = Breaker Lock
EO = Electrically Operated
FR = 100%
K = Key Interlock
MT = Meter
MTU = Meter Integral to Trip Unit
SPD = Surge Protective Device
ST = Shunt Trip

NCHP-MDP

Sect. No.	Unit No.	Description	Circuit Breaker Description			Connected Load (KVA)	Demand Load (KVA)	Comments
			Pole	Frame	Plug			
2	AB	M2	3	1200	1200	1200	MC	NOTE 3

2	CD	CHILLER COMP 1	3	1600	1600	1600	MC	NOTE 3
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3	BC	TIE BREAKER - TIE	3	2000	2000	2000	MC	100% Rated Breaker
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4	AB	M1	3	1200	1200	1200	MC	
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4	CD	CHILLER COMP 2	3	1600	1600	1600	MC	NOTE 3
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Notes:

- Top Entry Incoming Main Cables, Top Entry Outgoing Feeder Cables
- Main-Tie-Main Key Interlock, Only 2 of 3 Breakers may be closed at a time
- Meter furnished by Owner located in External Enclosure. Provide CTs, Shorting Block, Fuse Block, Etc for connecting External Meter at Breaker.

4

	KVA	Amps
*N+1 Connected Load	1944.6	2339.0
*N+1 Demand Load	2206.3	2653.8

*Equipment N+1 Sizing for (1) Chiller Compressor and Associated Auxiliaries

TYPE

PB = Power Breaker
IC = Insulated Case Breaker
MC = Fixed Molded Case Breaker

Circuit Breaker Functional Trip Option:

LI = Long-Instantaneous Settings
LSI = Long-Short-Instantaneous Settings
LSIG = Long-Short-Instantaneous-Ground Fault Settings
LSIA = Long-Short-Instantaneous-Ground Fault Alarm Settings

Circuit Breaker Option Legend

AFR = Arc Flash Reduction Mode
BL = Breaker Lock
EO = Electrically Operated
FR = 100%
K = Key Interlock
MT = Meter
MTU = Meter Integral to Trip Unit
SPD = Surge Protective Device
ST = Shunt Trip