ADDENDUM NO. 1
JUNE 23, 2026

2026 ELECTRICAL UPGRADE – PHASE 2
NEBRASKA STATE OFFICE BUILDING
DAS/STATE OF NEBRASKA BUILDING DIVISION
JEO PROJECT NO. 191852.03

THIS ADDENDUM IS ISSUED BY JEO CONSULTING GROUP, INC. TO ALL WHO HAVE OBTAINED OR RECEIVED BIDDING DOCUMENTS (PLANS, SPECIFICATIONS, AND/OR PROPOSED CONTRACT DOCUMENTS) FOR ABOVE LISTED PROJECT.

THIS ADDENDUM IS HEREBY MADE A PART OF THE BIDDING DOCUMENTS OR CONTRACT DOCUMENTS, AS APPROPRIATE. BIDDERS ARE REQUIRED TO ACKNOWLEDGE RECEIPT OF THIS ADDENDUM IN APPROPRIATE SPACE ON THE BID FORM.

COORDINATING PROFESSIONAL

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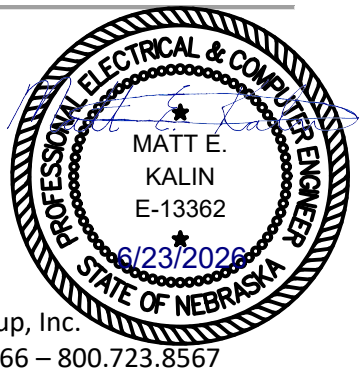


SUBMITTING ORGANIZATION(S)

Engineering Organization legal name: JEO Consulting Group, Inc.
Contact information: 1937 N Chestnut St, Wahoo, NE 68066 – 800.723.8567
Organization certificate of authorization number: CA-0069

Architecture Organization legal name: JEO Architecture, Inc.
Contact information: 1937 N Chestnut St, Wahoo, NE 68066 – 800.723.8567
Organization certificate of authorization number: CA-3929

Organization legal name: Alvine and Associates, Inc.
Contact information: 1201 Cass Street, Omaha, NE 68102 – 402.346.7007
Organization certificate of authorization number: CA-2169

CHANGES TO PROJECT SPECIFICATIONS:

1. Refer to “Table of Contents” in front of Specifications.

   Amend the Contents to include the following: ‘Division 08, Specification Section 08 11 13 – Hollow Metal Doors and Frames.’

   Amend the Contents to include the following: ‘Division 08, Specification Section 08 71 00 – Door Hardware.’

Amend the Contents to include the following: ‘Division 09, Specification Section 09 90 00 – Paints and Coatings.’

Amend the Contents to include the following: 'Division 23, Heating, Ventilating, and Air Conditioning (HVAC).’

Delete the following Section: ’26 13 19 – Medium-Voltage Vacuum Interrupter Switchgear.’

Amend the Contents to include the following: ‘Division 26, Specification Section 26 32 13 – Standby Generator System.’

2. Refer to Project Special Conditions.

   Add Project Special Conditions, attached hereto and incorporated into the Contract Documents.

3. Refer to Division 23 – Heating, Ventilating, and Air Conditioning (HVAC).

   Add Specification Section 23 05 13 – Common Motor Requirements for HVAC Equipment, attached hereto and incorporated into the Contract Documents.

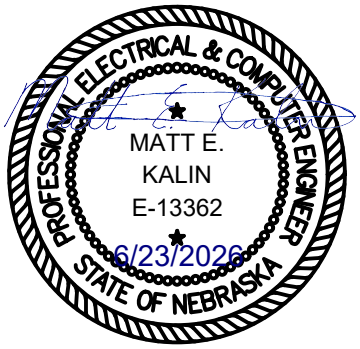
   Delete the duplicate occurrence of Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment.

4. Refer to Division 26 – Electrical Work.

   Add Specification Section 26 00 00 – Electrical Work, attached hereto and incorporated into the Contract Documents.

All other requirements of the Plans, Specifications and Contract Documents remain in effect. This addendum shall be attached to and made a part of the Plans, Specifications and Contract Documents and receipt shall be acknowledged by the Bidder on the Proposal submitted.

END OF ADDENDUM NUMBER 1



Matt E. Kalin, P.E.
June 23, 2026

SPECIAL CONDITIONS

1. The following sections of the GENERAL CONDITIONS shall be deleted in full unless otherwise noted:

NA

2. PROFESSIONAL SERVICES

The professional Engineer Services for this project are furnished by JEO Consulting Group, Inc.

3. SANITARY FACILITIES:

Arrangements shall be made by the Contractor for provision of a sanitary facility for use by the workmen. Approval by Owner of arrangements shall be required

4. UTILITIES:

Water and electrical service is available for the Contractor's use at no extra cost the Contractor. The Contractor shall furnish his own connecting lines, pipes, hoses, etc., from the source made available by the Owner.

5. SPECIAL REQUIREMENTS FOR STATE BUILDING DIVISION CONSTRUCTION CONTRACTS

The Contractor, upon signing the Contract, agrees to comply with the following Special Requirements:

FAIR LABOR STANDARDS

The undersigned states that he is complying with, and will continue to comply with, fair labor standards in pursuit of his business and in the execution of this Agreement.

NON-DISCRIMINATION IN EMPLOYMENT

The undersigned agrees that in performance of this Agreement neither he nor his subcontractors will discriminate against any of their employees or applicants for employment concerning the employees' or applicants' hire, tenure, terms, conditions, or privileges of employment based on the employees' or applicants' race, color, religion, sex, marital status, age, disability, or national origin.

DRUG FREE WORK PLACE POLICY

The Contractor certifies that as a condition of the Agreement neither the Contractor nor any employee of the Contractor shall engage in the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance in conducting any activity covered by this Agreement. The Department of Administrative Services reserves the right to request a copy of

the Contractor's Drug Free Workplace policy. The Contractor further agrees to insert a provision similar to this statement in all subcontracts for services required under this Agreement.

AMERICANS WITH DISABILITIES ACT

All provisions of this Agreement are subject to the Americans With Disabilities Act (29 C.F.R. 1601,28 C.F.R. 35)

CONTRACT AGREEMENT SOLICITATION STATEMENT

As per requirements of Sections 81-1716 through 81-1719, Revised Statutes of Nebraska, 1943, the Contractor warrants that he has not employed or retained any company or person, other than bonafide employees working for him, to solicit or secure this agreement and that he has not paid, or agreed to pay, any person, company, corporation, individual, or firm, other than a bonafide employee working solely for him, any fee, commission, percentage, gift, or any other consideration contingent upon or resulting from the award for the making of this agreement.

6. PRE-CONSTRUCTION CONFERENCE:

Prior to commencement of on-site work, the Contractor and any Subcontractors shall meet at the project site with the Consultant, SBD Project Manager, and representatives of the Facility for the purpose of reviewing the materials , methods, and procedures to be followed in performing the work in compliance with the Contract documents.

NOTICE: All listed materials approval submittals shall be approved by the Engineer before the Pre-Construction Conference is scheduled.

7. SUBSTITUTE MATERIAL SPECIFICATIONS

If the Contractor desires to substitute any material for that specified in these project documents, the Contractor shall submit specifications for such substitute material to *(Consultant)*
for approval before bid opening. Such submittals shall be made in time to be received by *(Consultant)*
a minimum of seven (7) working days before the bids due date to allow for examination and notification of action to prospective bidders.

8. AIA DOCUMENTS

American Institute of Architects (A.I.A.) Documents referred to in the project documents are available at: A.I.A. Nebraska, 838 N. 8th St A, Lincoln, NE 68508; Telephone Number (402) 858 - 1929.

9. CONSTRUCTION SCHEDULE

The Contractor shall submit a detailed complete construction project schedule to the Consultant for review and approval within (4) weeks of receipt of the signed Contract. The

schedule shall include proposed construction start and completion dates, as well as all major construction project milestones. Schedule shall include all project work including Subcontractor work.

10. PERMITS, INSPECTIONS, AND FEES

The Contractor shall be responsible for acquisition of and payment for all permits required by Authorities having jurisdiction over this project site. The Contractor shall also be responsible for scheduling and attendance of all Inspections required upon completion of the work and shall pay all fees associated with such inspections

11. PROGRESS MEETINGS

After start of on-site construction work, progress meetings shall be scheduled at dates and times agreeable to the Contractor, Engineer, and representatives of the facility. Meetings may be held for purposes of discussion of issues including but not limited to construction progress, resolving construction problems, schedule, security, and changes.

12. BACKGROUND CHECKS (delete if NOT required)

The Contractor shall contact the Nebraska State Patrol to obtain criminal background checks on all employees associated with this project (excluding delivery drivers, but including all subcontractors). All background checks shall be submitted to the Facility Maintenance Manager for approval who will determine if any employees will be denied access to work in the facility. The Owner's decision shall be final.

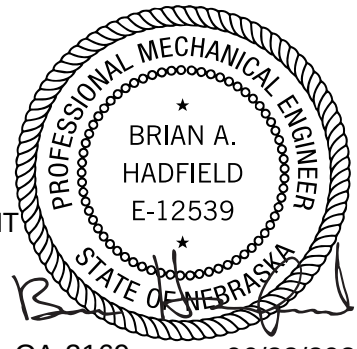
The Contractor is responsible for maintaining a current list of authorized personnel at the job site. Contractors shall complete the "Criminal History Requests" on the Nebraska State Patrol's website:
https://statepatrol.nebraska.gov/services/criminal-history-record-requests

Background check results will be returned within three (3) business days. The Contractor shall submit in a timely manner as to not impede the start and completion of work on-site. Personnel are not allowed to be on-site unless this verification has been performed and the record is maintained on-site.

END OF SPECIAL CONDITIONS

SECTION 23 05 13

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT



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PART 1 GENERAL

1.1 RELATED REQUIREMENTS

A. Section 26 29 13 - Enclosed Controllers.

1.2 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; 2015, with Errata (2026).

B. IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators; 2017.

C. NEMA MG 00001 - Motors and Generators; 2024.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

PART 2 PRODUCTS

2.1 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Construction:
1. Open drip-proof type except where specifically noted otherwise.
2. Design for continuous operation in 104 degrees F (40 degrees C) environment.
3. Design for temperature rise in accordance with NEMA MG 00001 limits for insulation class, service factor, and motor enclosure type.

B. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.

C. Wiring Terminations:
1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

2.2 APPLICATIONS

2.3 THREE PHASE POWER - SQUIRREL CAGE MOTORS

A. Starting Torque: Between 1 and 1-1/2 times full load torque.

B. Starting Current: Six times full load current.

C. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.

D. Design, Construction, Testing, and Performance: Comply with NEMA MG 00001 for Design B motors.

E. Insulation System: NEMA Class B or better.

F. Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.

G. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.

H. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid state control relay for wiring into motor starter; refer to Section 26 29 13.

I. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA STD 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

J. Sound Power Levels: To NEMA MG 00001.

K. Nominal Efficiency: As indicated at full load and rated voltage when tested in accordance with IEEE 112.

L. Nominal Power Factor: As indicated at full load and rated voltage when tested in accordance with IEEE 112.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

C. Check line voltage and phase and ensure agreement with nameplate.

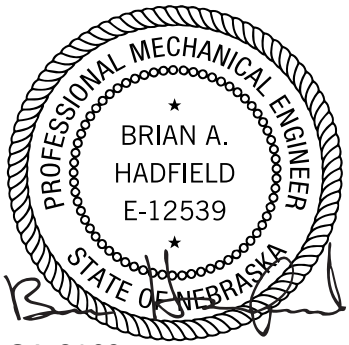
3.2 SCHEDULE

A. Three Phase - Energy Efficient, Open Drip-Proof Performance:
   1. 1200 rpm.
      a. 15 hp:
         1) NEMA Frame: 284T.

2) Minimum Percent Power Factor: 77.
3) Minimum Percent Efficiency: 90.

2. 1800 rpm.
   a. 15 hp:
      1) NEMA Frame: 256T.
      2) Minimum Percent Power Factor: 85.
      3) Minimum Percent Efficiency: 91.

3. 3600 rpm.
   a. 15 hp:
      1) NEMA Frame: 215T.
      2) Minimum Percent Power Factor: 89.
      3) Minimum Percent Efficiency: 89.



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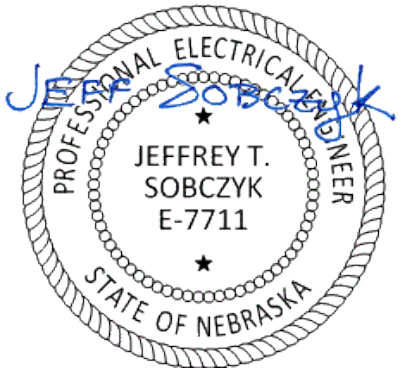
END OF SECTION



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SECTION 26 00 00

ELECTRICAL WORK

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Extent of electrical work is indicated by drawings and schedules and by requirements of this section. Work includes the following:

B. General Work: The work associated with electrical systems and equipment to be performed as electrical work includes excavating, conduit sleeves, conduit supports, anchors, metering, motor starters, lighting, power, miscellaneous systems, welding, identification, coordination of drawings, record drawings, permits, tests, inspection, electrical work for temporary facilities, certain cutting and patching work, utility connection, starting up systems, training of Owner's operating personnel, producing operating and maintenance manuals, and construction permits.

1. Power: The extent of the power work is indicated in the contract documents by E-Series drawings. This work includes conduit, wire, boxes, receptacles, starters, disconnects, panels, and all equipment required for a complete installation. Wiring of equipment furnished by other specification Divisions or by the Owner that requires electrical power connections shall be wired in accordance with manufacturer’s instructions.

C. Refer to Section 03 30 00 for concrete work associated with the electrical work.

1.02 QUALITY ASSURANCE

A. General: In addition to complying with local codes, ordinances, standards and regulations, comply with:

1. Independent Testing Laboratories (ITL)
2. Electrical Testing Laboratories (ETL)
3. Certified Ballast Manufacturer (CBM)
4. Factory Mutual (FM)
5. Institute of Electrical and Electronic Engineers (IEEE)
6. Underwriters' Laboratories, Inc. (UL)
7. National Fire Protection Association (NFPA)
8. American Society for Testing and Materials (ASTM)
9. American National Standards Institute (ANSI)
10. National Electrical Code (NEC)
11. National Electrical Safety Code (NESC)
12. Public Law 101-336 Definition of Requirements for "Americans with Disabilities Act of 1990"
13. Insulated Power Cable Engineers Association (IPCEA)
14. American Institute of Steel Construction (AISC)
15. State & Municipal Codes in Force in the Specific Project Area
16. Occupational Safety and Health Association (OSHA)

1.03 SUBSTITUTIONS

A. Pre-Bid Substitution Requests: Unless indicated otherwise, in general, products indicated are a basis of design and pre-bid substitutions are allowed per the requirements of Section 01 10 00 and the Instructions to Bidders.

1. If a specific product is listed without an “or approved equal/equivalent” clause, then the product listed shall be the product provided. This is generally restricted to products in which compatibility with other equipment or existing equipment is necessary.
2. If a specific product is specified without a Basis of Design manufacturer and product catalog number/series, or a list of approved manufacturers then a pre-bid substitution request is not required.

1.04 SUBMITTALS

A. General: The Contractor shall submit to the Engineer, for approval, electronic PDF copies of shop drawings of all major items of equipment and/or systems, giving manufacturer's name, catalog numbers, etc., and shall in particular set forth any variation or substitution from that intended by plans and specifications. Submittals shall consist of a Bill of Materials for major items included in the submittal, manufacturer’s catalog page indicating general features and listings, and shop drawings. Electronic PDF files shall be text searchable and include bookmarks for major sections for ease of navigation.

B. Shop drawings shall be submitted for review for the following:

1. 2-Hour Fire Resistive Cable System
2. Cable vertical supports
3. Enclosed circuit breakers
4. Motor starters
5. Panelboards
6. Transformers

C. Operational & Maintenance Manuals: Provide O & M Manuals in accordance with Sections 01 10 00.

1. Provide manufacturer’s O & M or instruction Manuals for panelboards, switchboards, motor starters, power quality meters, surge protective devices, and electronic circuit breakers, ground fault relays, and arc flash energy reduction switches.
2. Provide copies of all field electrical testing reports as a part the O & M Manuals.
3. Include engineering studies that indicate adjustable circuit breaker settings, short-circuit calculations, arc flash energies, etc. Unless indicated otherwise, these studies will be furnished by Engineer for inclusion in the O & M Manual.
4. In addition to paper copies, an electronic version shall be provided in PDF format. The PDF file shall be text searchable and organized the same as paper copy complete with bookmarks for each indexed tab section.

1.05 COORDINATION OF ELECTRICAL WORK

A. Coordination of Work: The Contractor shall be responsible for the coordination electrical work with the work all other suppliers and installers for this Project.

B. Coordinate and install wiring for appliances and systems furnished under other specification Divisions, furnished by the Owner, other Bid Packages or in some instances furnished under separate Contract. It is the intent of this requirement, that anything with an electrical connection will have power, and be working properly at Substantial Completion unless indicated otherwise. Verify outlet box sizes for various components such as wall switches and indicators. Install electrical wiring in accordance with manufacturer's instructions. Items requiring some installation by the Electrical Contractor that are furnished by others include, but not limited to: Generator fuel day tank and monitoring system, HVAC dampers.

C. For some items that are provided for this Project provided by others, product substitutions may result in changes to the electrical systems indicated. When Contractor initiated product variations result in electrical system changes, coordinate those changes at no additional cost to the Owner.

D. The Electrical Contractor shall be responsible for coordinating the electrical requirements of items provided under Division 26. Make field adjustments as necessary for variations in product requirements provided under Division 26 at no additional cost to the Owner.

1. The power requirements for the generator are the responsibility of the Electrical Contractor to coordinate as part of the Bid.

E. Coordinate service outages of the service utilities with the Owner and General Contractor for proper sequencing of work and for protection of the Owner's operations.

1.06 POWER OUTAGES

A. Any and all power outages for any panelboard or portion of the building shall be pre-planned and coordinated in advance with the Owner. See Section 01 10 00.

B. In general, power outages during normal business hours will not be allowed for any portion of the building. It is expected that any panelboard that serves building tenants can only be de-energized during off-business hours, primarily weekends and holidays, see Specification Section 01 10 00 "Special Provisions". Any de-energized equipment shall be returned to the energized state prior to the beginning of the next business day.

C. Workflow and phasing of work shall be planned so that all tenant power can be restored to an energized state during the allotted outage time prior to the beginning of the next business day.

D. There shall be field testing of equipment and feeders prior to re-energization to prevent failures that would prevent re-energization in a timely manner.

1.07 REMODELING WORK

A. Removals: Where feeders are made obsolete and abandoned, remove all portions of the exposed raceway and raceways above suspended ceilings.

B. Replacing Feeders: Where feeders are indicated to be replaced for a panelboard or other equipment which is to remain or being replaced in the same location, the feeder conductors shall be replaced. It is permissible for the Contractor to re-use the existing raceway at their discretion. There shall be no post-bid price changes for any raceway replacement for a feeder that is indicated to be replaced.

C. Certain remodeling of electrical facilities will be required in the existing building. The drawings showing location of outlets in existing areas are approximate only. Existing outlets not shown on the plans shall be coordinated with the Engineer/Owner but there

shall be no additional cost included. Existing conduit runs are not shown. Branch circuits shall be reused where practical and shall in addition be remodeled as required.

D. Existing electrical wiring which will not be made obsolete and which will be disturbed due to construction changes required by this contract shall be restored to operating condition as required and/or directed. Outlets from which fixtures, switches, receptacles, and/or other electrical devices are removed, and which are not replaced or reused, shall be removed where required, or if not to be removed, place blank cover on the outlet box. Where required, shown and/or directed, outlets and conduit runs shall be relocated as required by the electrical remodeling. Where outlets, boxes, etc., are completely removed, the Contractor shall cut-off conduits and remove wiring. In some cases it may be necessary to extend conduits and pull in new wiring or install junction boxes and splice in new wiring or replace old wiring with new.

E. Where conduits extending through floors are to be removed because the raceway has been abandoned, the floor fire rating must be maintained. Patch the floor per details on the plans or using only approved methods. See Specification Section 07 84 00 “Firestopping”.

F. The Contractor shall be held fully responsible for the proper restoration of all existing surfaces requiring patching, plastering, painting and/or other repair due to transporting, handling, and the installation of electrical work under the terms of this specification. Close all openings, repair all surfaces, etc., as required.

1. Replace ceiling tiles damaged during removal and reinstallation with matching ceiling tiles as close as possible. See Specification Section 01 10 00.

G. The Contractor shall employ only qualified and experienced workmen for this work. All restoration work shall be subject to the approval of the Architect/Engineer and/or the Owner.

1.08 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Handle all electrical equipment carefully to prevent breakage, denting, and scoring finishes.

B. Deliver all electrical equipment in factory fabricated fiberboard type containers.

C. All electrical equipment to be installed on the job shall be stored indoors in a clean, dry space having a uniform temperature to prevent condensation.

D. All conduit shall be stored off the ground to insure that no dirt or debris is allowed to enter them before installation.

E. Failure to store material correctly shall be just cause for the Engineer to direct the Contractor to remove the material from the site.

F. Protect electrical equipment from mechanical damage during handling and storage.

1.09 PERMITS AND FEES

A. The Contractor shall familiarize himself with all requirements as to permits, fees, codes and ordinances, etc., and arrange to comply with them.

B. AHJ Fees: Unless indicated otherwise, all permits, licenses, fees, inspections, and arrangements with Authorities Having Jurisdiction (AHJ) required for the work under this contract shall be obtained by the Contractor at his expense.

C. The Contractor shall field coordinate and provide all temporary power required.

1.10 CODES

A. All work shall be in accordance with applicable State and Local Codes. All work shall comply with the rules and recommendations of the National Fire Protection Association, all requirements of local utility companies, and the State Fire Inspection Bureau. These codes, rules, recommendations, and requirements shall take precedence if the drawings and specifications are not in conformance therewith.

1.11 LABELS AND IDENTIFICATION

A. Equipment Identification: All identification labels shall be installed in a neat and workmanlike manner. Cleans surfaces prior to installation.

1. All Panels shall have identification labels of the equipment neatly stenciled on the equipment. Labels shall be 1 inch wide plastic "black" with 3/8 inch engraved letters "white". Labels shall be permanently glued to equipment in a neat fashion. Label shall have the complete name of the equipment as well as its mark or number, such as "Panel EL1".

a. Panel labelling shall be extended to all panelboards in the building, including existing panelboards.

2. All disconnect switches and starters installed as part of this project shall have identification of the equipment being served neatly stenciled on the switch. Labels shall be 1 inch wide plastic "black" with 3/8 inch engraved letters "white". Labels shall be permanently glued to equipment in a neat fashion. Label shall have the complete name of the equipment as well as its mark or number, such as "Electric Unit Heater EH-1".

B. Wiring:

1. All control and alarm wires shall have self-adhesive wraparound type identification labels at each panel, enclosure, and termination. Labels shall be machine printed by thermal transfer or equivalent process. Identification of each wire shall be unique and shall match terminals within the equipment.

C. Terminal Strips: Each control terminal strip shall have an identification label identifying the terminal strip. In addition, each terminal on the strip shall be uniquely numbered.

D. Motor Starters and Starters within MCC's: For each motor starter, provide a self-adhesive vinyl label that identifies the following for the specific motor installed: horsepower, full-load amperes, and starting code. In addition, provide a laminated copy of the manufacturer's control diagram for components within the enclosure. The control diagram shall identify the terminal numbers and control wiring identification numbers for each component, relay, terminal strip, pilot device, etc. This labeling shall be installed on the inside of the unit door.

E. Available Short-Circuit & Power Source: Applies to all enclosed circuit breakers, panelboards, switchboards, and motor control centers: This labelling shall be machine printed adhesive vinyl. The label shall conform to ANSI Z535.4. The signal word shall be "NOTICE" on a blue background. Provide with the following information:

1. The available short-circuit current per NEC 408.6 and 430.99. Engineer to calculate and provide the available short-circuit currents which incorporate transformer nameplate impedances and field installed feeder lengths. Coordinate with the Engineer for field installed feeder lengths.

2. Identifies the equipment where the power originates per NEC 408.4(B). This identification shall indicate the equipment ID and the location.

3. Example:

Panel 5LBA

Source = Panel DPL-5B, 5th Floor NE Elec Rm

Available short-circuit:

3PH = 7.7 kA

SLG = 6.4 kA

4. Existing Equipment: Because of the electrical system infrastructure changes occurring as a result of this project and the previous medium-voltage phase I project, the available short-circuit and the source of power to each panel and other equipment is subject to change. As part of this Contract, each existing panelboard and MCC to remain shall be marked with the available short-circuit. This information for the label shall be calculated and provided by the Engineer.

F. Conductor Color Coding: Applies to all enclosed circuit breakers, panelboards, switchboards, and motor control centers. Identify ungrounded conductor color coding system per NEC 210.5 for all new equipment.

G. Enclosed Circuit Breakers, Panelboards, Switchboards, and Motor Control Centers: Arc Flash Hazard Warning per NEC 110.16. The Contractor is responsible for generic arc flash warning labels.

a. The Engineer will provide the equipment specific arc flash labeling.

H. Circuit Directories:

1. Replaced Panelboards: For each panelboard that is indicated to be replaced, provide an identification label for each existing branch circuit conductor prior to removing the panelboard. Provide machine printed circuit directory card for the new panelboard based on the as found conditions of the existing circuit directory. Terminate the existing conductors at the appropriate circuit breaker on the new panelboard so that the circuit matches the circuit directory.

a. Remove the old circuit directory card and place in the circuit directory card holder of the new panelboard.

2. New Panelboards: Provide machine printed circuit directory card for the As-Built conditions for each panelboard. In lieu of a circuit directory card, it is acceptable to utilize machine printed flexible self-adhesive vinyl labels at each circuit breaker.

3. Switchboards, and Distribution Panelboards: At each feeder breaker, provide a machine printed flexible self-adhesive vinyl label identifying the load served.

4. Motor Control Centers: At each new feeder/branch circuit breaker or starter cubicle, provide an engraved plastic identification label. This label shall be white print on gray background and mechanically fastened to cubicle door.

I. Medium-Voltage Switchgear: Provide a machine printed, flexible self-adhesive vinyl label that identifies the available fault current per NEC 110.24. If the available fault is not identified on the drawings, verify levels with the Engineer.

1. This label shall be compliant with ANSI Z535.4 with the signal word “NOTICE” using white lettering on a safety blue background.

J. Quadrant Main Disconnects: At the secondary disconnect for the medium-voltage transformers, provide a placard identifying the location of each of the other medium-voltage secondary disconnects and the location of the primary feeder disconnect per NEC 235.352(F) [NFPA 70-2023]. Provide companion placard at the medium-voltage switchgear with same information.

1. The placard shall be durable, UV resistant, rust resistant, and permanent. Painted metal with laminate overlay, or painted 1/16" plastic with laminate overlay.

1.12 SPARE PARTS

A. At Substantial Completion, provide spare parts as enumerated herein.

1. Fuses: For each fusible panelboard, provide 20% spare fuses.

PART 2 - PRODUCTS

2.01 ELECTRICAL RACEWAYS

A. General: For each electrical raceway system indicated, provide assembly of conduit, tubing or duct, and fittings, included but not necessarily limited to, connectors, couplings, off sets, elbows, straps, bushings, expansion joints, hangers, and other components and accessories as needed for a complete system. Minimum size of conduit shall be 3/4 inch. All conduit shall be new.

B. RMC: Rigid steel conduit complying with ANSI C80.1 shall be listed to UL 6, standard weight, mild-steel, hot-dipped galvanized or sherardized inside and out.

C. EMT: Electrical Metallic Tubing complying with ANSI C80.3 and listed to UL 797 shall be galvanized steel tubing with a zinc coating on the outside and a protective enamel coating on the inside.

1. For fire alarm systems raceway, provide EMT with a red outer paint or coating.

D. LFMC shall have continuous copper content or separate grounding conductor, shall be listed to UL 360 and shall be "Seal-Tite" Type "UA," as manufactured by Anaconda or the approved equal. The connections shall be a maximum of 24 inches in length.

E. RTRC-XW: Fiberglass Reinforced Thermosetting Resin Conduit (RTRC), heavy wall Type XW. Raceway shall be manufactured to NEMA TC 14, and listed to UL 2525 and UL 94 HB.

F. Each length of conduit shall be stamped with the name or trademark of the manufacturer and shall bear the Underwriter's label.

2.02 RACEWAY FITTINGS

A. All raceway fittings shall be listed to UL 514B.

B. Bushings and lockouts for galvanized steel raceway shall be made of galvanized malleable iron and shall have sharp clean-out threads for rigid conduit. Compression type shall be used for EMT.

C. Compression fittings for EMT used for fire pump circuits shall listed as raintight or for wet locations.

D. Expansion joint fittings shall be Type XJ/XJG-long or other conduit fittings as manufactured by Crouse-Hinds or equal for RMC and IMC.

2.03 RACEWAY SUPPORT

A. Galvanized Steel Support Systems: Structural-grade, factory formed, galvanized steel channels and angles with 9/16 inch diameter holes at a maximum of 8 inches o.c. in at least 1 surface.

1. Fitting and Accessory materials: Same as channels and angles. Stainless steel may also be used.

2. Rated Strength: Selected to suit applicable load criteria.

2.04 CONDUCTORS

A. A complete system of copper conductors shall be installed in a raceway system with green ground wire throughout the building for all feeder and branch circuits, etc. Wire shall be copper, 600-V minimum rating, except for special systems. No wire smaller than No. 12 gauge shall be used, except for signal or control systems, or where otherwise indicated.

B. Insulation Types:

1. #10 and smaller shall be Type THWN-2 rated for 90°C.

2. #8 and larger shall be Type THWN-2 or XHHW-2 rated for 90°C.

3. Unless noted otherwise, control wiring shall be Type XHHW-2 rated for 90°C.

C. Cables shall conform to the requirements of the Underwriter's Laboratories, Inc and shall be listed by a Nationally Recognized Testing Laboratory. THWN-2 cable shall be listed to UL 83. XHHW-2 cable shall be listed to UL 44.

D. 2-Hour Fire Resistive Cable System: Cables and cable systems specifically designed to meet NFPA 70 Articles 695, 700 and 772 for 2-hour fire resistive cable systems. The cables are part of a listed assembly and all cable and raceways utilized shall be listed for the assembly in accordance with manufacturer's instructions. Use manufacturer-approved splices, termination kits, and connectors, where allowed.

1. Power Cables: 600V, 90°C, RHH, Copper cable, listed to UL 44 and listed to UL 2196 for fire resistive cable. Complies with IEEE 1202/FT4-ST1 vertical flame test, and FT2 horizontal flame test.

a. Available manufacturers:

(1) Radix Wire & Cable, DuraLife, FPLR systems.

(2) Others meeting listing requirements.

2. Power-limited Circuit Cable: Listed to UL 13, UL Category QPTZ.

E. All wire shall be brought to the job in unbroken packages and shall bear the date of manufacture and shall not be older than 12 months.

F. Color Coding: Except for fire resistive cable assemblies, all wiring shall be color-coded throughout its entire length.

1. 1 phase SN 120/240V

a. Line 1 – Black

b. Line 2 – Red

c. Neutrals –White

d. Ground – Green

2. 3 phase SN 120/240(208)V
    a. Phase A – Black
    b. Phase B – Red
    c. Phase C – Blue
    d. Neutrals - white
    e. Ground - Green
3. 3 Phase SN 277/480V
    a. Phase A – Brown
    b. Phase B – Orange
    c. Phase C – Yellow
    d. Neutrals – Gray
    e. Ground – Green
4. 125VDC.
    a. Positive – Black
    b. Negative – Red
    c. Ground - Green
5. Fire Resistive Cable Systems: Each phase conductor for feeders utilizing fire resistive cable systems shall have color coded electrical tape at each termination point and junction/pull box. The color coding shall match the system voltage color coding.

G. Analog Instrumentation Cables: Control cables for analog or digital signals shall be UL listed PLTC, rated for 90°C, shielded twisted pair, with XLPE insulation, minimum size #18 AWG. Outer jacket shall be lead-free, flame-retardant, and sun-light resistant. Cables used in outdoor or underground applications shall also be listed for direct burial or wet locations. Cables installed in hazardous locations shall also be listed as “gas/vapor tight continuous sheath”. For conductor lengths greater than 150 lineal feet, minimum size shall be #14 AWG.

H. Communications Cables: Cables for RS-485 communications shall be Category 5 shielded twisted pair, designed to EIA/TIA 485. Cables shall be listed to UL 444. Use cables complying with NFPA 262 and listed Type CMP.

I. Conductor Splices and Taps:
1. Interior and Dry Locations:
    a. Taps of Condcutors #10 AWG or smaller may use wire-nut connections listed to UL 486.
    b. Splicing of Conductors #10 AWG or smaller shall be by one of the following methods:
        (1) Conductors shall be twisted together and soldered. All uninsulated splices, joints and free ends of conductors shall be covered with heat shrink rubber insulating sleeve or equal. Splice kits shall be listed for the application.
        (2) Listed preinsulated spring-pressure connectors, such as "Scotch-lok" or equal.

c. Splicing and Termination of Conductors #8 AWG or larger:

(1) Conductors shall be connected using insulated secondary set-screw connectors. Connector Manufacturing Co. Type NACC or approved equal.

(2) Connection to ground conductors #1 and smaller shall be by irreversible compression connectors.

(3) Connection to ground conductors No. 1/0 AWG and larger shall be either irreversible compression connectors or exothermic weld connections.

2. Wet Locations: Unless indicated otherwise, conductor splices and taps in wet locations shall utilize connectors listed to UL 486D for wet locations.

3. Motor Lead Splices: For motors that have flying lead wires, provide listed motor lead splice kit, inline type. Provide 3M, 5300 Series or approved equal.

2.05 CABLE VERTICAL SUPPORTS

A. Cable vertical supports may be any listed code compliant method. Fitting must be NRTL listed to UL 514B. Size per number of conductors and diameter of conductors.

2.06 GROUNDING

A. Clamps and Connectors: Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

1. Bolted Connectors: Listed to UL 467, clamp type, sized for pipe, copper or copper alloy, bolted pressure type with at least two bolts.

2. Welded Connectors: Listed to UL 467 exothermic welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

3. Compression Connectors: Listed to UL 467, 600 V, and minimum 75°C, dual rated for copper and aluminum, one or two-hole type as applicable, irreversible compression type connectors.

B. Ground Bar: Listed to UL 467 and suitable for copper conductors. Mount on insulating stand-offs. Minimum size shall be as indicated. Provide a hole pattern designed to match two hole compression conductor terminations.

C. Bare Copper Conductor:

1. #4 and Smaller: Single strand, solid meeting ASTM B3.

2. #3 and Larger: Soft-drawn copper, ASTM B8 stranding.

2.07 ELECTRICAL BOXES AND FITTINGS

A. The Contractor shall provide and install all back boxes as required for the equipment and/or systems under the terms of the contract.

B. All cabinets and boxes shall be secured by means of toggle bolts on hollow masonry; expansion shields and machine screws or standard preset inserts on concrete or solid masonry; machine screws or bolts on metal surfaces; and wood screws on wood construction.

C. Non-Corrosive/Ordinary/Unclassified Areas: All pull and junction boxes shall be substantially well made code gauge galvanized steel boxes, with bolted or screw covers. Located as approved by the Architect/Engineer. All pull or junction boxes must conform to the NEC. Box covers exposed in finished rooms shall be painted two coats as directed.

1. The minimum size at junction boxes shall be a 4 inch square galvanized outlet box with blank cover in unfinished areas and with a 2 gang plaster ring and blank plate in finished areas.
2. Boxes in wet locations shall be equipped with conduit hubs and shall be gasketed and water proof.
3. All switch and outlet boxes shall be approved galvanized steel knockout boxes. All outlet boxes must conform to provisions of Article 314 of the N.E.C.

2.08 PANELBOARDS

A. All equipment shall be manufactured by Square D, AB Rockwell, Cutler Hammer, Siemens, or Cooper/Bussmann.

B. All panelboards shall be listed to UL 67. All panels shall be dead front in accordance with schedule and notations on the electrical drawings.

C. All busses shall be silver-plated copper, or tin-plated copper.

D. Overcurrent Protective Devices: Both circuit breaker type panelboards and fusible switch type panelboards are required on this project. Overcurrent devices will be assumed to be circuit breaker unless the panelboard is indicated to be a fusible type.

1. Circuit Breakers: Circuit breakers shall comply with and be listed to UL 489. The individual breakers shall be calibrated and sealed to eliminate tampering or unauthorized changes in calibration. Breakers shall be interchangeable and capable of being operated in any position.
    a. Individual circuit breakers shall be fully rated for the available short-circuit rating of the panelboard, series ratings are prohibited.
    b. Circuit breakers are thermal magnetic trip units unless electronic trip units are indicated by “LSIG” or any combination of those letters. Adjustable trip setting dials shall be accessible from the front without having to remove a deadfront cover.
    c. Circuit breakers of frame size of 200 Amperes and greater shall have an adjustable instantaneous trip.
    d. All circuit breakers 15 ampere through 30 ampere and any other circuit breaker used to protect mechanical HVAC equipment shall be listed and labeled as HACR type.
    e. Two-pole and three-pole branch breakers shall be single-handle, common trip type. 15 and 20 amp breakers shall be (SWD) switching duty rated. All branch breakers shall be 20 amp one-pole unless indicated otherwise.
    f. Tandem or half-sized circuit breakers will not be acceptable.
    g. Breakers shall be the bolt-on type.
    h. Where circuit breakers are indicated to be GFCI type, they shall be listed to UL 943, Class A, with a trip at 4-6 mA.

2. Fuses:

a. Individual fuses shall be fully rated for the available short-circuit rating of the panelboard, series ratings are prohibited.

b. Fuses shall be Class CF, dual element, time delay, indicating type, and listed to UL 248-17. Fuses shall be dimensionally compatible with the provided branch circuit disconnect.

c. Branch Disconnects: Provide circuit protector base to hold the cube type fuse designed to fit in a standard circuit breaker mounting height, and also provide disconnecting means for the branch circuit. The disconnect shall be listed to UL 98 and have terminals rated for 75°C and compatible with copper and aluminum conductors.

d. Provide six (6) spare fuse spaces/compartments for each fusible panelboard.

E. A suitable directory or card holder shall be mounted on the inside of each cabinet door. Each circuit thereon shall bear a typewritten notation covered with transparent celluloid designated exactly what it controls. These cards shall be made out after the circuits have been connected.

F. Enclosures: Cabinets, wiring gutters, etc., shall be in strict accordance with the standard practice of the NEMA and the National Electric Code. All panels shall be flush or surface mounted as shown on the drawings. Provide the NEMA environmental rating suitable for the environment or as indicated. Enclosures shall be listed to UL 50 and have the NEMA enclosure rating as indicated.

1. Doors shall have concealed hinges.

2. Panel and trim shall be factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.

3. Back Boxes: Unless indicated otherwise, galvanized steel.

G. Distribution Panelboards:

1. NEMA PB 1, power and feeder distribution type.

2. Distribution panel shall have voltage and wiring configuration indicated, main breaker as indicated, minimum AIC as indicated fully rated and branch breakers as indicated. Square D type I-Line.

H. Lighting and Appliance Panelboards:

1. NEMA PB 1, lighting and appliance branch-circuit type.

2. Doors shall be secured with flush latch with tumbler lock. All panelboards on a project shall be keyed alike.

3. All Lighting Panels shall be 120/240(208)V or 277/480V single phase 3 wire or three-phase 4 wire, main breaker as indicated, and bolt-on branch breakers as indicated. Minimum short-circuit rating as indicated, but not less than 10 kAIC. Square D type NQ or NF or equal.

2.09 TRANSFORMERS

A. Available Manufacturers: Cutler-Hammer/Eaton, Allen-Bradley/Rockwell/General Electric, Hammond Power Solutions, Siemens Energy & Automation, Square D / Schneider Electric.

B. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers." Comply with NEMA ST 20 and list and label as complying with UL 1561.

C. General: Factory-assembled and tested units for 60 Hz service.

D. Insulation Class: 220°C, UL-component recognized insulation system with a maximum of 115°C rise above 40°C ambient temperature.

E. Enclosure: Ventilated, NEMA 250, Type 2. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.

1. Wall mounted enclosure: Units below 15 kVA shall be suitable for wall mounting.

2. Floor Mounted: Units 15 kVA and larger shall be suitable for floor mounting on a concrete housekeeping pad.

F. Taps:

1. Transformers Smaller Than or Equal to 3 kVA: One 5% tap above normal full capacity.

2. Transformers 5kVA to 24 kVA: One 5% tap above and one 5% tap below normal full capacity.

3. Transformers 25kVA and Larger: Two 2.5% taps above and four 2.5% taps below normal full capacity.

2.10 SAFETY AND DISCONNECT SWITCHES

A. Disconnect switches for all equipment and motors indicated on the plans shall be by one Manufacturer Square D, AB Rockwell, Cutler Hammer or Siemens. Square D and Appleton Catalog numbers are specified herein as a basis for quality and type of device to be installed.

B. Disconnect horsepower rating shall be appropriate for the motor(s) served.

C. Disconnects for integral horsepower motors, 3/4 horsepower and larger, and for equipment of similar capacity shall be NEMA KS 1, Type HD, industrial type, 600 V, fused or non-fused as indicated, 3 blades with solid neutrals where required and have provision of padlocking in the "ON" or "OFF" positions. Disconnect switches shall be listed to UL 98.

1. At interior locations enclosures shall be NEMA Type 1.

2. At exterior locations enclosures shall be NEMA Type 3R.

D. Enclosed Circuit Breakers: Enclosed circuit breakers shall be listed to UL 50 and UL 489 and comply with NEMA AB 1. Unless noted otherwise, the enclosure shall be surface mounted with NEMA 250 enclosure environmental rating as indicated. Where neutral conductors or indicated with the feeder, provide a neutral bus. Provide grounding conductor terminals.

1. Where used as the secondary disconnect for medium-voltage transformers, the enclosed circuit breaker shall be service rated.

2. Individual circuit breakers shall be fully rated for the available short-circuit, series ratings are prohibited.

3. Circuit breakers are thermal magnetic trip units unless electronic trip units are indicated by “LSIG” or any combination of those letters. Adjustable trip setting dials shall be accessible from the front.

4. Thermal-Magnetic trip circuit breakers of frame size of 200 Amperes and greater shall have an adjustable instantaneous trip.

5. Two-pole and three-pole branch breakers shall be single-handle, common trip type. 30 amp and below breakers shall be (SWD) switching duty rated.

6. Operating handle shall have means to lock in the OPEN position. Where indicated or otherwise required by code, means to lock in the CLOSED position shall also be provided.

2.11 MOTOR STARTERS

A. General: Motor controllers shall be listed to UL 508A. Except as otherwise indicated, provide motor starters and ancillary components; which comply with manufacturer's standard materials, design and construction in accordance with published product information, and as required for complete installation. Where more than one type of equipment meets indicated requirements, selection is Installer's option.

B. AC Fractional HP Manual Starters: Provide manual single-phase fractional HP motor starters, of types, ratings and electrical characteristics indicated; equip with thermal overload relay with field adjustment capability of plus or minus 10 percent variation of nominal overload heater rating, for protection of 120 VAC motors of 1/3 HP and less. Provide starters with quick-make, quick-break trip free toggle mechanisms, green pilot lights, selector switches for local or remote control, and with toggle operated handle with handle lock-off; mount starter in NEMA Type 1 general purpose enclosure at interior locations and in NEMA Type 3R enclosure at exterior locations.

C. Combination Non-Reversing Starters: Provide full-voltage alternating-current combination non-reversing starters, consisting of starters and disconnect switches mounted in common enclosures; of types, sizes, ratings, and NEMA sizes as indicated. Equip starters with overload relays, control fusing, under voltage phase protection, elapse time meter and with fusible or non-fusible disconnect switches as indicated. Provide operating handle for disconnect switch mechanism providing indication and control of switch position with enclosure door open or closed; and capable of being locked in OFF position with three padlocks. Provide "Hand-Off-Auto" switch with red “off” and green “run” pilot lights. Provide additional contacts for elapse time meters and additional equipment as indicated on the plans. Provide with control power transformer. Construct and mount starters and disconnect switches in single enclosure.

1. Phase Failure Relay shall include adjustable voltage thresholds with 0.3-30 second adjustable time delay. Relay shall be energized during fault free operation and de-energized during detection of voltage phase imbalance fault, phase failure or phase reversal fault. Square D Type RM35UB330 or approved equal.

D. Overload Relays: Solid-state overload relays with selectable Class 10, 20, or 30 trip delay. Relays shall have field adjustable motor current rating.

2.12 POWER RELAYS

A. Damper Control Relays: Relays shall be UL listed, heavy-duty, industrial grade. Contacts shall be 240VAC, 20 Amperes, ½ Horsepower minimum, SPST or DPST configuration. Coils shall be rated 120 VAC. Relays may be open frame construction. Provide in enclosure rated NEMA 4X, non-metallic sized appropriately for the relay. Provide pre-

printed vinyl adhesive label identifying “DAMPER CONTROL RELAY” and if more than one in a space, identify which damper it controls.

2.13 SURGE PROTECTIVE DEVICE (SPD)

A. SPD shall be Component Recognized in accordance with UL 1449 4th Edition, Standard for Safety, Surge Protective Devices, and UL 1283, Electromagnetic Interference Filters.

B. SPD shall be a Type 2 device and shall be installed for panelboards as indicated.

C. SPD shall incorporate thermally protected metal-oxide varistors (MOV’s) as the core surge suppression component for the service entrance and all other distribution levels.

D. SPD shall provide suppression for all modes of protection: L-L, L-N, L-G and N-G in WYE systems. For delta configured systems, the SPD shall have components directly connected between each phase conductor and between each phase conductor and ground.

E. SPD shall have a minimum Short Circuit Current Rating (SCCR) of 100kA.

F. SPD shall have a minimum surge current rating as follows:

1. Panelboards, 400A and Greater: 200 kA per phase (100 kA per mode).
2. Panelboards, 250A and Less: 100 kA per phase (50 kA per mode).

G. SPD shall be capable of protecting against and surviving 20,000 ANSI/IEEE C62.41 Category C3 impulses with less than 10% change in the baseline to final let-through voltage.

H. UL 1449 Listed Voltage Protection Ratings (VPRs) shall not exceed the following:

VOLTAGE	L-N	L-G	N-G	L-L
208Y/120	900V	1200V	700V	1500V
480Y/277	1200V	2000V	1200V	2500V

I. SPD shall be designed to withstand a maximum continuous operating voltage (MCOV) of not less than 115% of nominal RMS operating system voltages.

J. SPD shall have a minimum EMI/RFI filtering of -50dB at 100kHz using the MIL STD. 220A insertion loss test method.

K. SPD shall be equipped with onboard visual and audible diagnostic monitoring. Red and green indicator lights shall provide full time visual diagnostic monitoring of the operational status of each phase. The SPD diagnostic monitoring devices shall be mounted on the front of the SPD enclosure. The diagnostic monitoring circuits shall continually monitor the operational status of the surge current diversion modules. No other test equipment shall be required for SPD monitoring or testing before or after installation.

L. SPD shall have a response time no greater than one nanosecond for any of the individual protection modes.

M. SPD manufacturer shall provide a warranty for a period of ten (10) years from the date of shipment against any SPD part failure.

N. SPD shall not be integral to the panelboard. Unit shall be mounted adjacent to panelboard.

O. Provide Square D HWA and EMB series, or equal.

2.14 WIRING DEVICES

A. General: Provide factory-fabricated wiring devices, in types, colors, and electrical ratings for applications indicated and complying with NEMA Stds. Pub. No. WD 1. Receptacles shall be listed to UL 498. Where types and grades are not indicated, provide proper selection as determined by Installer to fulfill wiring requirements, and complying with NEC and NEMA standards for wiring devices. Provide ivory color devices and cover plates as indicated; color selection to be verified by Contractor with Architect/Engineer.

B. GFCI Receptacles: Comply with NEMA Stds. Pub No WD1 as follows:

1. GFCI: Provide specification duplex, ground fault circuit interrupter receptacles, termination type, capable of protecting connected down stream receptacles on single circuit, grounding type, UL 943 rated Class A, Group 2, 20-ampere rating, 125-volts, 60-Hz; with solid state ground fault sensing and signaling; with 5 milliampere ground fault trip level; equipped with 20-ampere plug configuration, NEMA 5-20R. See plan for symbol indicating GFI receptacle grade.
    a. Ground Fault Circuit Interrupted Type
    b. 2-pole, 3-wire grounded
    c. 20 Amp, 125 Volt
    d. Specification Grade
    e. Leviton No. 6898-G, Gray

C. Non-classified cover plates shall be stainless steel Type 302.

D. All weather proof cover plates shall be “In-Use” type that are raintight while in use and shall be die-cast zinc weather resistant. Provide neoprene type gaskets. Provide Intermatic model WP1010MXD or equal.

2.15 LIGHTING CENTRAL BATTERY INVERTER

A. General: Central battery inverter designed to provide power to emergency lighting complete with battery energy storage. Listed to UL 924. Output power is pure sine wave and is compatible with LED and fluorescent luminaires. Upon loss of line side power, the unit shall operate the load at 100% of its full rated output.

B. Ratings:

1. Output: 750 W
2. Input Voltage: 120/277 V Universal voltage.
3. Output Voltage: 120/277 V Universal voltage.
4. Emergency Output Duration: 90 minutes minimum at full load output.

C. Unit has listed surge protective device tested and listed to UL 1449, 4th Edition, and designed in accordance with IEEE C62.41 (surge environment), IEEE C62.45 (test methods), and IEEE C62.72 (application). MOV-based SPDs shall comply with IEEE C62.11.

D. Unit shall include self-diagnostic and will automatically conduct monthly and annual tests. Unit has momentary contact test switch. Unit has charging indicator and self-test indicator. Unit has audible alarm indicator.

E. Batteries shall be maintenance free and design lifetime of 10 years. Battery charger is variable rate type with trickle charge capability.

PART 3 - EXECUTION

3.01 ELECTRICAL WORK, GENERAL

A. All electrical work shall be done in a neat and workmanlike manner as defined by NECA 1 "Standard Practices for Good Workmanship in Electrical Contracting".

B. Installation of electrical systems, equipment and raceways shall be done in accordance with the latest version of the appropriate NECA standard.

1. Installation of motors and motor controllers shall be in accordance with NECA 230.
2. Installation of panelboards shall be in accordance with NECA 407.
3. Installation of dry type transformers shall be in accordance with NECA 409.

C. GFCI Receptacles and Devices: Unless specifically noted otherwise, GFCI receptacles shall be wired with the line side terminals only so that a ground fault trip only de-energizes that receptacle and allows other receptacles on the same branch circuit to remain energized.

D. Mechanical Room: Wall mounted equipment on exterior walls in the mechanical room shall have a stand-off bracket or strut channel to prevent liquids running down the wall from ingressing into the equipment.

3.02 GROUNDING

A. Grounding of the electrical service shall be in accordance with the NEC and NECA 331 "Standard for Building and Service Entrance Grounding and Bonding". Provide grounding electrode conductor to each grounding electrode at each structure.

B. All connections between conductors that are part of the grounding electrode conductor and grounding electrode system shall be either irreversible compression connectors or exothermically welded.

C. Provide a green insulated copper equipment grounding conductor in each feeder and branch circuit installed under this Contract.

D. Equipment Ground.

1. Any conductor used solely for grounding purpose, equipment grounding, etc., shall be green unless bare.
2. All wiring throughout the entire project for all of the various systems shall be furnished with a ground wire and color coded in accordance with the needs of the particular system. Wire must be color coded throughout its entire length.
3. The practice of color coding or tagging wire ends will not be acceptable, except for feeders which shall be color coded at both ends.
4. VFD Cables shall be terminated in accordance with manufacturer's instructions. Particular care shall be taken for the termination and bonding of the shield conductor.

3.03 ELECTRICAL TESTING

A. Testing shall be performed before re-energization.

B. Perform electrical testing where required by NFPA 70 and as specified herein. Electrical testing shall be performed by qualified personnel trained for the specific test required

and with the testing equipment utilized. A written test report shall be provided to the Owner as part of the Operations & Maintenance Manual. Test reports shall also be made available to the AHJ upon requests.

1. Ground Fault Protection: All circuit breakers or relays that have ground fault protection shall be performance tested using primary current injection.
2. Arc Energy Reduction: Where arc energy reduction is provided and as required by NFPA 70, the reduction mechanism shall be performance tested. Testing shall be performed in accordance with manufacturer's instructions and shall utilize primary injection testing methods or another manufacturers recommended method approved by the Authority Having Jurisdiction.
3. Feeders: Acceptance tests shall be performed on all feeders 400A and larger.
    a. Visual & Mechanical Inspection:
        (1) Inspect exposed sections of cable for physical damage and correct connection.
        (2) Inspect bolted electrical connections for high resistance using calibrated torque-wrench method.
        (3) Inspect for correct identification, rotation, and arrangements.
    b. Electrical Tests:
        (1) Perform resistance measurements through bolted connections with low-resistance ohmmeter.
        (2) Perform insulation-resistance test on each conductor with respect to ground and adjacent conductors. Applied potential shall be 500VDC for one minute or as stated in NETA ATS.
        (3) Perform continuity test to insure correct cable connection.
        (4) Verify uniform resistance of parallel conductors.
4. Dry-Type Transformers:
    a. Visual & Mechanical Inspections:
        (1) Inspect physical and mechanical condition.
        (2) Inspect anchorage, alignment, and grounding.
        (3) Verify that resilient mounts are free and that any shipping brackets have been removed.
        (4) Verify the unit is clean.
        (5) Verify tightness of accessible bolted electrical connectins by calibrated torque-wrench method in accordance with manufacturer's published data.
    b. Electrical Tests:
        (1) Perform resistance measurements through bolted connections with a low-resistance ohmmeter.
        (2) Perform insulation-resistance tests winding-to-winding and each winding-to-ground. Apply voltage in accordance with manufacturer's published data or NETA ATS.
        (3) Verify correct secondary voltage phase-to-pahse and phase-to-neutral after energization and prior to loading.

5. Enclosed Circuit Breakers, 800A and larger.

a. Visual & Mechanical Inspection:

(1) Operate the circuit breaker to insure smooth operation.

(2) Verify the unit is clean.

(3) Inspect anchorage & alignment.

(4) Set adjustable settings per protective device coordination study. Protective Device Coordination study is by the Engineer.

(5) Inspect bolted electrical connections for high resistance using calibrated torque-wrench method.

b. Electrical Tests:

(1) Perform resistance measurements through bolted connections with a low-resistance ohmmeter.

(2) Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with circuit breaker closed and across each open pole. Apply 1000VDC. Minimum insulation resistance shall be 100 MΩ.

3.04 CONCRETE PADS

A. General: Interior concrete housekeeping pads shall be 4 inches above finished floor with a chamfered edge. Cutouts shall be provided for bottom raceway entry. Interior concrete pads for generators shall be structurally isolated from the surrounding floor to reduce vibration transmission to the building. Outdoor concrete pads shall be a minimum of 6 inches above finished grade with a chamfered edge and steel reinforcing bars.

B. Provide concrete housekeeping pads for all floor distribution panelboards.

C. Provide concrete housekeeping pads for all interior 3 phase dry-type transformers and single phase dry type transformers of 25 kVA and larger.

D. Single phase transformers 15 kVA and smaller shall be wall mounted. For stud type walls, provide additional blocking and support in stud frame for support. Transformers shall be secured by means of toggle bolts on hollow masonry; expansion shields and machine screws or standard preset inserts on concrete or solid masonry; machine screws or bolts on metal surfaces; and wood screws on wood construction.

E. Provide generator concrete pads housekeeping pad. It is permissible to extend the existing concrete pad to match the generator dimensions.

3.05 EQUIPMENT SUPPORT

A. Application of Support Systems: Unless noted otherwise, types of raceway and equipment support systems shall be as follows:

1. Interior: Galvanized steel strut and raceway support systems.

2. Outdoors and Exterior Environment: Galvanized steel strut and raceway support system.

B. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.

2. To New Concrete: Bolt to concrete inserts.

3. To Existing Concrete: Expansion anchor fasteners.

4. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units. In corrosive environments, bolts shall be stainless steel.

5. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.

6. To Light Steel: Sheet metal screws.

7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

C. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

D. Three phase transformers 15 kVA and less and single phase transformers shall be wall mounted. Provide manufactured wall bracket designed for the load or fabricate wall mounting system with strut channels angles or similar designed for the load.

3.06 COMBINING OF CIRCUITS IN RACEWAYS

A. Combining of Circuits in Raceways:

1. Permissible: For power branch circuits of the same voltage, it is permissible to combine circuits in the same raceway. For these instances, the Contractor shall adjust conductor sizes in accordance with NEC de-rating factors for number of current carrying conductors in a raceway and adjust conduit sizes as necessary for raceway fill at no additional cost.

2. Prohibited:

a. Unless specifically indicated on the plans, control wiring shall not be routed in the same raceway as power branch circuits or feeder circuits.

b. Unless specifically indicated on the plans, analog signal wiring (4-20mA loop circuits) shall not be routed in the same raceway as control wiring.

c. Unless specifically indicated on the plans, analog signal wiring (4-20mA) loop circuits) shall not be routed in the same raceway as power branch circuits and feeders.

d. Raceways containing generator start command circuits shall not contain conductors for any other purpose.

3.07 CONDUIT

A. Electrical raceways shall be installed in accordance with NECA 101 “Standard for Installing Steel Conduit (Rigid, IMC, EMT)” and NECA 111 “Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC)”.

B. Application of Raceways: Unless noted otherwise, types of raceways shall be applied as follows.

1. Indoors:

a. Above-grade: Galvanized EMT with compression fittings.

b. Vibrating Equipment (Transformers and Motors): FMC.

c. Fire Pump Feeders: EMT with wet location compression fittings.

d. ATS Control Circuits: EMT or RTRC-XW.

e. Emergency Generator Feeders: EMT or RTRC-XW.

f. Fire Alarm Circuits: Red colored EMT.

g. Grounding Electrode System Bonding Jumpers: RTRC-XW.

2. Exterior:

a. Above-grade: RMC.

b. Vibrating Equipment (Transformers and Motors): LFMC

C. RMC: Each joint shall be made up wrench tight at couplings and unions, threaded hubs of junction box, device boxes, conduit bodies, etc. All sealing fittings shall be accessible.

D. Raceways running across floors in exterior vaults or mechanical rooms racway shall be secured to strut channels to hold the raceway off of the floor to allow liquids to pass underneath. The strut channels shall be secured to the floor.

E. Conduit sizes for various numbers and sizes of wire shall be as recommended by the latest edition of the National Electric Code and the latest supplements thereto. Conduit size shall be increased in size when lead-covered cable is required by the National Electric Code or this specification.

F. No conduit shall be used where the required number and sizes of wires cannot be easily "pulled in" and the Contractor shall be responsible for the selection of the conduit sizes. Conduit sizes shown on the drawings are "minimum" sizes in accordance with appropriate tables in the National Electric Code. If because of bends of elbows a larger conduit size is required, the Contractor shall so furnish without further cost to the Owner.

G. The entire conduit system shall be installed complete, thoroughly cleaned and all conduit fished before the wires are pulled in. Conduit shall be continuous from outlet to outlet, cabinet or junction box, and shall be so arranged that wire may be pulled in with the minimum practicable number of junction boxes.

H. The conduits shall be run as required by the structural design of the building. All conduits in finished rooms shall be run above ceilings. All raceways, which are not buried, or embedded in concrete, shall be supported by straps, suitable clamps or hangars to provide a rigid installation.

I. Concealed conduits shall be run so as to come below finished floors, in walls or above ceilings and shall be run so as to clear all depressions in floors, plumbing and heating pipes and to be placed in the concrete forms so as not to interfere with the steel or strength of slabs and joints. The Contractor shall inpsect field conditions before running conduit to ascertain where his piping might conflict with other piping or equipment.

J. Exposed conduit shall be run in straight lines at right angles to or parallel with walls, beams or columns. In no case shall conduit be supported or fastened to other pipe, or installed to prevent the ready removal of other pipe for repairs.

K. The ends of all conduits shall be securely plugged, and all boxes temporarily covered to prevent plaster or dirt from entering the conduits. All conduit shall be thoroughly swabbed out with a dry swab to remove moisture and debris before conductors are drawn into place.

L. The Contractor shall be entirely responsible for the proper protection of this work from the other trades on the job. When conduit becomes bent or holes are punched through same, or outlets moved after being roughed-in, the Contractor shall repair same as directed, without additional cost to the Owner.

M. Changes in direction shall be made by bends in the pipe wherever possible and these shall be made smooth and even without flattening the pipe or flaking the finish. Bends shall be as long radius as possible and in no case smaller than the corresponding trade elbow. Long-radius elbows shall be used where necessary.

N. RTRC: Nonmetallic raceway bends shall be made with factory fabricated bends whenever possible. Field bends shall be made with a hot-box designed for the purpose. Field bends shall not be made using a torch or flame. Raceways with torch burn marks shall be removed and replaced.

O. Not more than four 90 degree bends will be allowed in one raceway run. Where more bends are necessary, a conduit or pull box shall be installed. All bends in 1 inch and smaller shall be made with a conduit bender and all larger sizes shall have machine bends.

P. Where rigid conduits enter boxes, panels, cabinets, etc., they shall be rigidly clamped to the box by a locknut on the outside, and a bushing on the inside of the box for each conduit.

Q. Where thin wall conduit is used, EMT compression type fittings shall be used. Use wet location compression fittings for fire pump circuits.

R. All conduits shall enter the box squarely.

S. Furnish and install insulated bushings as required by NEC Article 300.5(G). The use of insulated bushings does not exclude the use of double locknuts to fasten conduit to the box.

T. Where conduits pass through exterior concrete walls or footings below grade the entrance shall be made watertight.

U. Conduits shall be supported at intervals not greater than 8 feet, within 3 feet of any bend and every outlet or junction box, panel, etc. This shall apply to vertical runs as well as horizontal runs.

V. Where conduits are run individually, they shall be supported by approved pipe straps, or beam clamps. Straps shall be secured by means of toggle bolts on hollow masonry; expansion shields and machine screws or standard preset inserts on concrete or solid masonry; machine screws or bolts on metal surfaces; and wood screws on wood construction.

W. No perforated straps or wire hangers of any kind will be permitted.

X. Where individual conduits are suspended from the ceiling, they shall be supported by hanger rods and hangars, Steel City #C-149 or approved equal.

Y. Conduits installed exposed in damp locations shall be provided with clamp backs under each conduit clamp to prevent accumulation of moisture around the conduits.

Z. Where a number of conduits are to be run exposed and parallel, one with another, they shall be grouped and supported by trapeze hangers.

AA. Hanger rods shall be fastened to structural steel members with suitable beam clamps or to concrete inserts set flush with surface. A reinforced rod shall be installed through the opening provided in the concrete inserts.

BB. Inserts shall be Steel City #D-255 or the approved equal.

CC. Beam clamps shall be suitable for structural members and conditions.

DD. Rods shall be galvanized steel or cadmium plates, 3/8 in. dia. minimum.

EE. Trapeze hangers shall be Steel City B-900, or the approved equal.

FF. Each conduit shall be clamped to the trapeze hanger with conduit clamps. Clamps for rigid conduit shall be Steel City No. C-105 or the approved equal. Clamps for electrical metallic tubing shall be Steel City No. C-106 or the approved equal.

GG. All concrete inserts and pipe straps in ordinary locations shall be galvanized.

HH. All steel bolts, washers and screws shall be stainless steel, galvanized, or cadmium-plated in ordinary locations.

II. Individual hangers, trapeze hangers and rods shall be prime-coated.

3.08 FIRE RESISTIVE CABLE SYSTEMS

A. Install in accordance with NFPA 70 Articles 695 and/or 700 and 772.

B. Install fire resistive cable systems in accordance with manufacturer's UL listed FHIT/FHIT7 fire resistive system instructions.

C. Maintain minimum bending radius per manufacturers instructions.

D. Pull cables using appropriate methods to avoid stretching or kinking. Do not exceed manufacturer's maximum pull tension.

E. Use only manufacturer approved termination kits or splice kits listed in the ul system.

F. Perform continuity testing after rough-in and after termination.

G. Where required by manufacturer, test insulation resistance. Defective cable segments shall be replaced; splicing to correct damage is not permitted unless UL system allows it.

H. Identification: Provide a label at all accessible points with: 2-HOUR FIRE-RESISTIVE CABLE UL 2196". Also identify the circuit at each pull or junction box.

3.09 SWITCH AND OUTLET BOXES

A. Boxes for switches and receptacles shall have proper covers to receive this equipment.

B. Where walls are of drywall plaster construction, do not fasten outlet boxes to wall material with or without box supports.

C. All wall mounted outlet boxes shall be supported by bar supports extending from the studs on either side of the box. No boxes shall be of the gangable type. All boxes shall have square cut covers to receive the drywall or other construction.

3.10 LUBRICANTS

A. Where lubrication is required for pulling conductors or cables it shall be a compound specifically prepared for cable pulling and shall not contain petroleum and other products which will have a deteriorating effect on the cable insulation.

B. Do not use lubrication for fire resistant assemblies.

END OF SECTION