Division 26 Electrical

1.1 260500 – COMMON WORK RESULTS FOR ELECTRICAL

A. Code Compliance: All work shall comply with the applicable laws and regulations of the City of Omaha and State of Nebraska. Electrical work shall conform to the latest adopted addition of the National Electrical Code (NEC), including any specific Omaha or Nebraska requirements.

B. Temporary power and lighting throughout the construction period, for use by all trades, shall be provided as part of the contract documents. The cost of temporary power, unless provided from an existing building system, shall be born by the Contractor.

C. The Architect/Engineer shall provide a schedule of electrical submittals to be utilized for monitoring submittal review and action in the contract documents.

D. All pieces of freestanding electrical equipment shall be installed on concrete pads, 3-1/2 inches above the surrounding slab, and 2-inch larger than the equipment on all sides. Pads shall be reinforced and shall have chamfered edges.

E. Existing roadways, curbs, and walks shall be protected from damage to as great an extent as possible. Any damage by the Contractor shall be repaired to original condition.

F. The contract documents shall specify the requirements for work in existing buildings. These requirements shall be coordinated with the Owner for the specific project.

G. Electrical Submittal Schedule:

ELECTRICAL SCHEDULE	PRODUCT DATA	SHOP DRAWINGS	MAINTENANCE DATA	SAMPLES	WARRANTY	OTHER
260513 - Medium-Voltage Cables	✓		✓			✓
260519 - Low Voltage Electrical Power Conductors and Cables						✓
260526 - Grounding and Bonding for Electrical Systems	✓					✓
260533 - Raceways and Boxes for Electrical Systems	✓	✓				✓
260553 - Identification for Electrical Systems	✓					
261200 - Medium-Voltage Transformers	✓		✓			✓
261300 - Medium-Voltage Switchgear	✓	✓	✓			✓
262200 - Low Voltage Transformers	✓	✓	✓		✓	✓
262413 - Switchboards	✓	✓	✓			✓

ELECTRICAL SCHEDULE	PRODUCT DATA	SHOP DRAWINGS	MAINTENANCE DATA	SAMPLES	WARRANTY	OTHER
262416 - Panelboards	✓	✓	✓			✓
262726 - Wiring Devices	✓	✓	✓			
262816 - Enclosed Switches and Circuit Breakers	✓	✓	✓			✓
262913 - Enclosed Controllers	✓	✓	✓			✓
262923 - Variable Frequency Motor Controllers	✓	✓	✓			✓
263213 - Engine Generators	✓	✓	✓		✓	✓
264313 - Transient Voltage Suppression for Low Voltage Electrical Power Circuits	✓		✓		✓	✓
265100 - Interior Lighting	✓	✓	✓			✓
265600 - Exterior Lighting	✓		✓			✓
283111 - Fire Alarm	✓	✓	✓		✓	✓

1.2 260513 – MEDIUM-VOLTAGE CABLES

A. Primary ductbank shall consist of one (1) active and one (1) spare 4 inch PVC Schedule 40 conduit.

B. Secondary ductbank shall consist of multiple Schedule 40 PVC conduits, sized to contain the secondary service conductors.

C. Primary cables shall be 15 kV rated, single-conductor copper with 133 percent rated, EPR rubber insulation. Cables shall be manufactured by Cablec, Hatfield, Okonite, Perelli, or Southwire. Cable connections shall be made by using load-break elbows.

D. Secondary cables shall be THWN or USE 600-volt cables.

1.3 260519 – LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

A. Conductor insulation for system voltages below 600 volts shall be THHN/THWN for branch circuits and THHN/THWN or XHHW for feeders No. 8 and larger.

B. Signaling and control circuits may be No. 14 AWG. All other branch circuits shall be No. 12 AWG minimum.

C. Dimmer Installation: Provide a separate neutral conductor for all dimmer controlled lighting circuits.

D. Provide #10 AWG neutral for multi-wire branch circuits.

E. Tests: Requirements for testing electrical systems shall vary by the requirements of the project. As a minimum, feeders below 600 volts shall be meggar tested. Circuits above 600 volts shall be high potential tested. Phase rotation for three-phase circuits shall be checked prior to energization. Submit copies of all testing to the Architect/Engineer prior to the substantial completion of the project.

F. Conductors shall be copper.

G. Provide stranded wire for conductors larger than #10 AWG.

1.4 260526 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

A. Provide green ground wire in each feeder and branch circuit.

B. Neutral conductor size shall match phase conductor size.

1.5 260533 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

A. Separation of Systems: The following wiring systems shall be run in separate independent raceway systems:

1. 120/208-volt systems
2. 277/480-volt systems
3. Fire alarm
4. Code-required emergency lighting and power
5. Non-code-required lighting and power
6. Telecommunications systems
7. Closed Circuit Television (CCTV) systems
8. Card access security systems

B. Provide colored conduit as required by other sections.

C. EMT fittings may be steel, compression or setscrew type.

D. Raceway Application:

1. Outdoors:
   a. Exposed: Rigid steel or IMC
   b. Concealed: Rigid steel or IMC
   c. Underground: PVC
   d. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC
   e. Boxes and Enclosures: NEMA 250, Type 3R
2. Indoors:
   a. Exposed Unfinished Area: EMT.
   b. Exposed Finished Area: Wiremold 2000 Series metallic raceway or larger where approved by Owner. Paint to match wall.

c. Concealed: EMT.
d. Concealed in Concrete Slab or Beneath Slab-on-Grade: PVC except for branch circuits served from life emergency systems, use RMC, IMC, or EMT.
e. Connection to Motors: LFMC.
f. Connection to Vibrating Equipment (Including Transformers and Pneumatic or Electric Solenoid Driven Equipment): FMC.
g. Wet Locations: Rigid steel conduit.
h. Beneath Raised Access Floors: LFMC for connections to equipment.
i. Boxes and Enclosures: NEMA 250, Type 1, except as follows: Wet Locations: NEMA 250, Type 4.

3. Minimum Raceway Size: 3/4-inch trade size.
   a. Minimum 1/2-inch for fire alarm and switch legs.
   b. Minimum 1-inch trade size for all telecommunications conduit unless otherwise indicated.

E. Floor boxes shall be Hubbell 3SFB Series. Other acceptable manufacturers shall be Steel City and Wiremold/Walker upon Owner approval.

F. Boxes for telecommunications shall be a minimum of 2-1/8 inches deep.

1.6 260553 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

A. Equipment Identification: Equipment shall be identified as follows:

1. Lighting panelboards, distribution panelboards, switchboards, motor control centers, feeder breakers in switchboards, and motor circuits in MCCs shall all be labeled with engraved nameplates and permanently fastened to the device or directly adjacent device being labeled. The titles for the labels shall be coordinated with the Owner. Name plates shall be melamine plastic laminate, minimum 1/16-inch thick for signs up to 20 sq. in. and 1/8-inch thick for larger sizes. Engrave legend with white letters on black face unless otherwise indicated. Minimum letter height shall be 1/4-inch.
2. Separately-mounted motor starters, disconnects, and circuit breakers shall be labeled with embossed labeling tape, equivalent to “Dymo” tape. The titles shall be coordinated with the Owner. Tape shall be 1/2-inch wide, white with black lettering, unless otherwise noted.

B. Circuit Identification Labels on Boxes: Install labels externally unless otherwise indicated.

1. Exposed Boxes in Publicly Occupied Spaces: Paint and label inside cover. Paint exterior of box to match color of surface installed upon.
2. Exposed Boxes in Unfinished Areas: Paint and label on cover.
3. Concealed Boxes Above Accessible Ceilings: Paint and label on cover.

4. Labeling Legend: Listing of panel and branch circuit number, or equivalent, using a black permanent ink marker unless otherwise indicated.
5. Paint Colors:
    a. 208Y/120V: Grey
    b. 480Y/277V: Orange
    c. Fire Alarm: Red
    d. Telephone: Blue
    e. Life Safety: Green
    f. Emergency: Yellow
    g. Door Access (Security): Brown
6. Where two colors are required, voltage shall be painted and system type shall be color taped on conduit. Apply colored tape on conduit with the same method as conductor color coding.

C. Conductor Color Coding: Use the following colors:

1. 208/120V Conductors:
    a. Phase A: Black
    b. Phase B: Red
    c. Phase C: Blue
    d. Neutral: White
    e. Ground: Green
    f. Isolated Ground: Green with stripe
2. 480/277V Conductors:
    a. Phase A: Brown
    b. Phase B: Orange
    c. Phase C: Yellow
    d. Neutral: White with a color stripe (not green) or gray
    e. Ground: Green
3. Factory apply color to the entire length of conductors, except the following field-applied color-coding methods may be used instead of factory-coded wire for sizes larger than No. 6 AWG.
    a. Colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Use 3/4-inch-wide tape in colors specified. Adjust tape bands to avoid obscuring cable identification markings.

1.7 261200 – MEDIUM-VOLTAGE TRANSFORMERS

A. New services shall be connected to the 13.8 kV loop-feed system.

B. Liquid-filled transformers shall be mineral oil-insulated, pad-mounted, five-legged core, dead front. Transformer impedence shall be 5.75 percent. Transformers shall have three (3) primary surge arrestors. Transformer primary

shall be set up for a loop feed. Provide non-load tap changer with two (2) 2-1/2 percent taps above and two (2) 2-1/2 percent taps below nominal voltage. Transformers shall be manufactured by Balteau Siemens, Square D, or General Electric.

C. Existing transformers shall be evaluated for PCBs.

1.8 261300 – MEDIUM-VOLTAGE SWITCHGEAR

A. Pad-mount switches shall be S&C PME-9 type with dead front construction.

1.9 262200 – LOW-VOLTAGE TRANSFORMERS

A. The manufacturer shall be one of the following:

1. Square D
2. General Electric
3. Siemens

B. Coils shall be continuous with no splices except for taps.

C. Rated temperature shall be a minimum of 115ºC rise over 40ºC for less than 300 kVA and 150ºC rise over 40ºC for 300 kVA and larger.

D. Taps: For transformers 3 kVA and larger, full-capacity taps in high-voltage windings are as follows:

1. Taps, 3 through 30 kVA: Four 2.5 percent taps, 2 above and 2 below rated voltage.
2. Taps, Above 30 kVA: Six 2.5 percent taps, 2 above and 4 below rated high voltage.

1.10 262413 - SWITCHBOARDS

A. The manufacturer shall be one of the following:

1. Square D
2. General Electric
3. Siemens.

B. Busbars shall be copper.

C. Equipment used as service entrance shall include a UL service entrance label and be provided with Owner metering and connection to tenant billing invoice system. Metering will be microprocessor-based having as a minimum, line-to-line and line-to-ground voltages, line currents, instantaneous kilowatts, kilovars, and power factor.

D. Horizontal buses shall be extendable for addition of future sections.

E. Panel interrupting capacities shall be calculated and shall be indicated on the contract documents.

F. Minimum bus bracing shall be 100,000 amps symmetrical.

G. Label each individual breaker with the load served.

1.11 262416 - PANELBOARDS

A. Lighting Panelboards:

1. The manufacturer shall be one of the following:
    a. Square D
    b. General Electric
    c. Siemens
2. Door-in-door construction is acceptable.
3. Load center construction is not acceptable.
4. For each panelboard, indicate the required interrupting rating of the assembly.
5. All breakers shall be bolt-on-type.
6. All 20-amp breakers shall be SWD labeled.
7. All breakers serving air conditioning and refrigeration equipment shall be HACR labeled.
8. Tandem or half-size circuit breakers are not permitted.
9. For any panels recessed in walls, provide a minimum of five (5) spare 3/4-inch conduits into the nearest accessible ceiling space.
10. Require a typewritten circuit directory for each panelboard.
11. If the overcurrent protection ahead of a panel is less than the panelboard rating, provide a permanently attached label to indicate the feeder overcurrent rating.
12. Bus bars shall be copper.

B. Distribution Panelboards:

1. Manufacturer shall be one of the following:
    a. Square D
    b. General Electric
    c. Siemens
2. Lighting panel construction is not acceptable.
3. Each individual circuit breaker shall be labeled with its load description.
4. Bus bars shall be copper.

1.12 262726 – WIRING DEVICES

A. The manufacturer shall be one of the following:

1. Bryant
2. General Electric

3. Leviton
4. P&S

B. Switches:

1. Specification grade.
2. Rated 20 amps.
3. Rated 120/277 volts ac.
4. Color shall be as selected by Owner.
5. Match switch requirements such as 3-way, 4-way, or keyed to specific requirements of application.

C. Receptacles:

1. Specification grade.
2. Rated 20 amps.
3. Color shall be as selected by Owner.
4. Provide ground-fault interrupter receptacles as required by code.
5. Provide ground-fault interrupter receptacles within 6 feet of any sink.

D. Device Plates: Device plates shall be selected depending on the type and area of the facility using the following general guidelines:

1. Public areas shall have be as selected by Owner.
2. Resident areas of residence halls shall use smooth-finish plastic (nylon or break resistant plastic) to match the color of the device.
3. Exposed boxes in unfinished areas shall have galvanized steel cover plates.
4. All weatherproof cover plates shall be metal or plastic.

E. Occupancy Sensors: Manufactured by Sensor Switch. Use type and technology to match application.

F. Wall Box Dimmers:

1. Match manufacturer of dimming ballast.
2. Slide-type with “Off” position.
3. Rotary-type dimmers are not acceptable.

1.13 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

A. The manufacturer shall be one of the following:

1. Square D
2. General Electric
3. Siemens

B. Disconnects:

1. Disconnects shall be NEMA 1 for indoor installation and NEMA 3R for outdoor installation.
2. Disconnect switches shall be heavy duty.

1.14 262913 – ENCLOSED CONTROLLERS

A. The manufacturer shall be one of the following:

1. Square D
2. General Electric
3. Siemens

B. Motor Starters:

1. Provide 3-phase, NEMA Class 20, solid-state overload relays and phase failure protection.
2. Combination starters shall include an integral disconnect and motor circuit protector (fusible switch).
3. Single-phase, manual motor starters shall include thermal element overload protection and a manual control switch.
4. When utilized, motor control centers shall include NEMA Class B wiring.
5. Pilot lights: Motor running (red), motor stopped (green)
6. Hand-Off-Auto switch
7. Reset button

C. All wiring shall be done in a workmanlike manner. Installation practices shall promote safe working conditions and operating conditions of installed systems.

1.15 262923 – VARIABLE FREQUENCY MOTOR CONTROLLERS

A. Acceptable variable frequency drive manufacturers include:

1. Asea Brown Boveri (ABB)
2. Graham
3. Reliance

B. For all drives more than 100 feet from driven motor, specify a dampened low-pass KLC output filter as manufactured by TCI of Milwaukee, Wisconsin. Amperage of KLC filter must match drive amperage.

C. Specify drive manufacturer to have an independent service organization and parts supplier.

D. All drives shall be communication-compatible with the campus energy management system.

E. Require that drive not be mounted on vibrating equipment.

F. Require factory testing prior to shipment and the availability of test procedures and results.

G. Require that drive start-up shall be performed by a factory-trained or certified technician at the expense of the drive supplier. Start-up shall include verification of proper drive operation at all speeds and in all models. The start-up technician shall make adjustments or repairs as required to provide proper drive operation to the satisfaction of the Owner.

H. Provide a minimum of two (2) hours of on-site instruction for the Owner's designated representative regarding the proper operation of each drive. Instruction shall be done at the convenience of the Owner. Instruction shall include a description of all the functions of all indicators and controls and a demonstration of the following:

1. Normal operating procedures – Automatic mode
2. Normal starting, stopping, speed control procedures – Manual operation mode
3. Bypass mode operation
4. Emergency shutdown

1.16 263213 – ENGINE GENERATORS

A. Packaged Engine Generators:

1. The manufacturer shall be one of the following:
   a. Caterpillar
   b. Kohler
   c. Onan
2. Filters shall be heavy duty.
3. Subbase, double-walled (or secondary containment) fuel tank for diesel generators.
4. Remote fuel fill box with 6-gallon containment and remote fuel fill alarm for diesel generators.
5. Float type battery charger.
6. Diesel or natural gas engineer.
7. Silencer shall be critical grade.
8. Exterior enclosures shall be NEMA 3R and approved by Owner.
9. Provide manually selectable voltage and amperage meter in automatic transfer switch to meter each phase on the load side.
10. Building Load Test:
    a. Use building load connected to genset.
    b. Interrupt normal power serving load.
    c. Supply load from generator power for two hours.
    d. Restore normal power.

B. Pipe Schedule:

SERVICE	MATERIAL
Engine generator exhaust piping	Standard weight black steel with welded joints

1.17 264313 - TRANSIENT VOLTAGE SUPPRESSION FOR LOW VOLTAGE ELECTRICAL POWER CIRCUITS

A. The manufacturer shall be one of the following:

1. Current Technology
2. Innovative Technology
3. General Electric
4. Advanced Protection Technologies
5. Square D.

B. Provide TVSS for all service entrances.

C. Provide TVSS for critical panels as defined by Owner/users.

D. Surge Protection Device Description:

1. Non-modular type with the following features and accessories:
   a. LED light for power and protection status.
   b. Audible alarm with silencing switch to indicate when protection has failed.
   c. One set of dry contacts rated at 5A 250V-AC for remote monitoring of protection status.
   d. Surge event operations counter.
   e. Fused devices shall allow rated surge current to flow through device.
2. Protection modes and UL 1449 SVR for 120/208V, 3 phase, 4 wire circuits:
   a. Line to Neutral: 500 volts
   b. Line to Ground: 500 volts
   c. Neutral to Ground: 500 volts
   d. Line to Line: 800 volts.
3. Protection modes and UL 1449 SVR for 277/480V, 3 phase, 4 wire circuits:
   a. Line to Neutral: 800 volts
   b. Line to Ground: 800 volts
   c. Neutral to Ground: 800 volts
   d. Line to Line: 1200 volts
4. Short circuit current rating shall match or exceed that specified for the panel from which the surge protection device is fed.

E. Installation of Surge Protection Devices:

1. Install remote devices with conductors between surge protection device and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length or 24 inches total, whichever is less. Do not bond neutral and ground.

1.18 265100 – INTERIOR LIGHTING

A. Fluorescent Ballasts:

1. The manufacturer shall be one of the following:
   a. Universal
   b. Advance
2. Electronic-type.
3. Total harmonic distortion shall not exceed 10 percent.

B. Compact fluorescent ballasts shall be 90% minimum power factor. Ballast leads shall be accessible to allow individual switching of each ballast.

C. Preheat fluorescent lamp ballasts shall be high power factor.

D. Lamps:

1. The manufacturer shall be Phillips.
2. Fluorescent lamps shall be T-8 with minimum light output of 2,800 lumens for 4-foot lamp. Minimum color rendering index shall be 75. Lamps shall be of the low-mercury type. Color temperature 4100ºK. Phillips AltoPlus 2 compact fluorescent lamps shall be minimum 80 CRI and color temperature 4100ºK.

E. Incandescent lamps shall be rated 130 volts.

F. Industrial or other open fixtures shall include lamp jackets.

G. Fluorescent electronic ballasts shall be manufactured by Universal or Advance.

H. Lamps shall be manufactured by Phillips.

I. Fluorescent lamps used in dimming fixtures shall be burned-in for 100 hours continuously before dimming.

J. Downlights: Lithonia AF Series with QDS option quick disconnect for easy ballast replacement.

K. Fixture lenses shall be 0.125-inch thick minimum.

L. Standard Lighting Fixtures:

1. Acrylic Lensed Fluorescent Troffer:
   a. Door: White flush steel.
   b. Lens: 0.125-inch thick clear acrylic, pattern 12.
   c. Door and Body: Painted after fabrication.

Manufacturer – Series
Columbia – 5PS-PAF
Day-Brite – Designer
Lithonia – SP with SL/20, GA and PAF options
Metalux – GC
Williams – EPG

2. Recessed Direct/Indirect:

Manufacturer – Series
Lithonia – 2AV
H. E. Williams – DIS
Metalux – RDI
Columbia – STR

3. Acrylic Lensed Surface Fluorescent:

a. Housing: White steel.
b. Door: White flush steel.
c. Lens: 0.125-inch thick acrylic, pattern 12.

Manufacturer – Series
Columbia – PM
Day-Brite – SM
Lithonia – M
Metalux – M/MC
Williams – 11, 12, 14

4. Parabolic Fluorescent Troffer:
   a. Louvers: Semi-specular.
   b. Cell Quantity: See drawings.
   c. Provide iridescent suppression louvers on all fixtures using tri-phosphor lamps.
   d. Provide fixtures meeting the IES RP-24 “preferred” standard.

Manufacturer – Series
Columbia – P-4
Day-Brite – Paralouver P3
Lightolier – DP
Lithonia – Paramax 3
Metalux – Paralux III
Williams – HE3

5. Industrial Fluorescent:
   a. Provide with uplight or solid top reflectors as indicated on drawings.

Manufacturer – Series
Columbia – KL
Lightolier – TF
Lithonia – AF
Metalux – DIM/CIM
Williams – 82

6. Strip Fluorescent:

Manufacturer – Series

Columbia – K
Lithonia – UN
Metalux – STN
Williams - 77

1.19 265600 - EXTERIOR LIGHTING

A. Provide pedestrian walkway lights as indicated in Appendix. Coordinate exact pole and fixture combination with Owner.

B. Exterior fixtures not attached to a building shall be metal halide.

C. Exterior fixtures shall be 208 volt.

D. Coordinate receptacle requirements and switching with Owner.