DIVISION 26 - ELECTRICAL

26 0501 MINOR ELECTRICAL DEMOLITION

A. Coordinate utility service outages with the UND Electrical Department.

B. Verify the abandoned wiring and equipment serve only abandoned facilities.

C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations and follow the safe working practice requirements of NFPA 70E.

D. Demolition and extension:

1. Remove, relocate, and extend existing installations to accommodate new construction.
2. Remove abandoned wiring to source of supply.
3. Provide revised typed circuit directory in panelboards that have circuits removed.
4. Remove exposed abandoned conduit and abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
5. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit and wiring serving them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.
6. Disconnect and remove abandoned panelboards and distribution equipment.
7. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
8. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

E. PCB Ballast Handling:

1. Generally, all high power factor fluorescent light ballasts manufactured before 1978 and some HID ballasts contain polychlorinated biphenyl (PCB) compounds in their capacitors. The Contractor shall inspect all ballasts in all light fixtures and take the actions described below.

   a. The disposal of all ballasts labeled as “NON-PCBs” or NO PCBs” shall become the responsibility of the Contractor. If the PCB content is not stated on the ballast label, the ballast shall be handled as a PCB ballast.

F. Lamp and PCB Ballast Disposal:
1. All lamps (fluorescent, incandescent, and HID) contain mercury and/or lead (in the base) as well as other heavy metals and compounds which are regulated by the EPA and DNR during the disposal process. As a result, regulations have been issued covering the handling and disposal of all lamps.

26 0513 MEDIUM-VOLTAGE CABLES

A. Preferred manufacturer The Okonite Company

B. Cable Type: Type MV 105.

C. Conductor: Copper.

D. Conductor Insulation: Ethylene-propylene rubber. Voltage Rating: 15 kV.

E. Insulation Thickness: 220 mils with a 133 percent insulation level.

F. Shielding: 1/3 neutral solid copper wires, helically applied over semiconducting insulation shield.

G. Load-Break Cable Terminators: Elbow-type units with 200-A-load make/break and continuous-current rating; coordinated with insulation diameter, conductor size, and material of cable being terminated. Include test point on terminator body that is capacitance coupled.

H. Connectors to be as manufactured by Cooper model T-OP II

I. High voltage underground lines shall have a yellow or red warning tape and be buried a minimum of 30 inches deep covered with six inches of sand and concrete slurry.

26 0519 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

26 0520 UNDER CARPET CABLES

A. Subject to review with owner

26 0526 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

A. Accurately record actual locations of grounding electrodes.

B. Rod Electrode:

1. Material: Copper-clad steel.

3. Length: 8 feet.

C. Exothermic Connections: Manufacturers: Caldwell

D. Installation:

1. Provide grounding electrode conductor and connect to reinforcing steel in foundation footing.

2. Bond together metal siding not attached to grounded structure; bond to ground.

3. Equipment Grounding Conductors: Provide separate, insulated conductor within each feeder circuit and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

4. Bonding: All interior metal water, sewer and gas piping shall be bonded together and connected to the grounding electrode conductor. Connect a bonding conductor from the structural steel system to the grounding electrode conductor.

5. Resistance to ground and between multiple ground electrodes shall be measured and recorded.
A. Steel Slotted Support Systems – galvanized steel.

B. Anchors and Fasteners:
   1. Concrete Structural Elements: Use precast insert system, expansion anchors and preset inserts.
   2. Steel Structural Elements: Use beam clamps, spring steel clips steel ramset fasteners, and welded fasteners.
   5. Solid Masonry Walls: Use expansion anchors and preset inserts.
   8. Plastic anchors are unacceptable in concrete or block walls. Properly applied nylon tap ins are acceptable.

C. Installation:
   1. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.
   2. Do not use spring steel clips and clamps.
   3. Do not use powder-actuated anchors.
   4. Install surface-mounted cabinets and panelboards with minimum of four anchors.
   5. In wet and damp locations, use steel channel supports to stand cabinets and panelboards one inch off wall.
   6. Provide a 3/4 inch plywood backboard for all communication and electrical closets. Cover with two coats of gray paint.
   7. Mount enclosures so that at least 1/4 inch air space is provided between the enclosure and the supporting surface.

26 0534 CONDUIT
A. A half inch (1/2") conduit shall be run from the top of entrance frames (both hollow metal frames and aluminum frames) to above the finished ceiling for door frames for electronically access controlled doors.

B. All spare and empty conduits to be used in the future shall be identified on termination end of each conduit for area served.

C. Electrical Metal Tubing (EMT): Set screw fittings are acceptable. Compression fittings are to be used where required.

D. Electrical Metal Tubing (EMT): Shall not be used in areas where subject to corrosive conditions unless specifically indicated, and then only a type with a bonded polyvinyl coating.

26 0535 SURFACE RACEWAYS

A. Wireway shall be galvanized sheet steel provided with full length hinged covers and coordinated fittings including tees, collars, elbows and a closing plate required for a completely enclosed raceway. Sheet metal parts shall be coated with a rust inhibitor and finished with baked enamel. Hardware shall be plated to prevent corrosion.

26 0536 CABLE TRAYS FOR ELECTRICAL SYSTEMS

26 0537 BOXES

A. Provide a junction box above dropped ceilings in outlet home run circuit for individual rooms.

B. Provide a junction box above dropped ceilings in individual rooms if multiple rooms exist on one run for future wiring.

C. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

D. Inaccessible ceiling areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

E. All home run junction boxes shall be legibly identified on cover with panel and circuit number.


26 0540 UNDERFLOOR DUCTS

A. Duct shall be 14 gauge steel with a corrosion resistant finish. System shall include all junction boxes, couplings, conduit adapters, elbows, crossunders, offsets and service fittings for a complete system.
A. Nameplates and Labels:

1. Construction shall be laminated phenolic plastic, white front and back with black core for normal power systems, and red front and back with white core for emergency power systems.

2. Lettering. Shall be at least 3/16” high for items where attached to a device plate.

3. Lettering shall be engraved 1 line Helvetica. Nameplates shall be securely fastened to the equipment to be identified, with No. 4 Phillips round head, cadmium plated, steel self-tapping screws, or nickel plated brass bolts.

4. Letter Size: Motor Control Centers, Switchboards and distribution panelboards shall be provided with 5/8” – 3 line Helvetica lettered nameplates.

B. Equipment requiring identification shall include:

1. Motor starters, magnetic and manual; motor control centers; push button stations; control panels.

2. Disconnect switches, fused and unfused; circuit breakers, contactors, or relays in separate enclosures.

3. Switchboards – panelboards; cabinets; distribution boards.

4. Switches (wall) controlling outlets for lighting fixtures or equipment where outlets are not located within sight of switch.

5. Switches controlling electrically operated breakers or shunt trip breakers.

6. Special systems at junction boxes, pull boxes, terminal cabinets, equipment racks, etc., or as detailed on the drawings. (Fire alarm, security system, etc.)

7. Communication cabinets.

C. Conduit identification shall be as follows:

1. Label spare conduits.

2. Legend:

   a. Fire alarm System: FA
   b. Telephone System: Tele.
   c. Data System: Data
d. Fiber Optic System: FO

D. Application:

1. Secondary service, feeder and branch circuit conductors throughout the project secondary electrical system shall be color coded as follows:

   **COLOR:**

<table>
<thead>
<tr>
<th>208/120V</th>
<th>480/277V</th>
<th>PHASE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>Brown</td>
<td>A</td>
</tr>
<tr>
<td>Red</td>
<td>Orange</td>
<td>B</td>
</tr>
<tr>
<td>Blue</td>
<td>Yellow</td>
<td>C</td>
</tr>
<tr>
<td>White</td>
<td>Gray</td>
<td>Neutral</td>
</tr>
<tr>
<td>Green</td>
<td>Green</td>
<td>Equipment ground and bonding.</td>
</tr>
<tr>
<td>Breen/Yellow</td>
<td>Green/Yellow</td>
<td>Isolated Ground</td>
</tr>
</tbody>
</table>

2. Switch-loop and traveler conductors and color identification shall be other than above.

26 0573 OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

26 0914 ELECTRICAL POWER MONITORING

A. See section 26 2100

26 0915 PEAK LOAD CONTROLLERS

26 0916 ELECTRIC CONTROLS AND RELAYS

26 0917 PROGRAMMABLE CONTROLLERS

26 0918 REMOTE CONTROL SWITCHING DEVICES

26 0919 ENCLOSED CONTACTORS

UNIVERSITY OF NORTH DAKOTA – DESIGN STANDARDS

Print Date: 11/4/2016
LIGHTING CONTROL DEVICES

A. SPST motion control devices shall be passive infrared and ultrasonic types.

B. Ceiling motion control devices shall be passive infrared types suitable for use with relay controlled lighting. Sensors shall be flush mounted in the ceilings. All control wiring shall be in raceway.

C. Use consideration for light level sensors and daylight controls where natural light can reduce artificial lighting requirements by owner approval.

D. Refer to ASHRAE 90.1 Lighting Control Standards

LIGHTING CONTROLS – WATTSTOPPER

A. Low-voltage sensors with relays to control lights.

NETWORK LIGHTING CONTROLS – CRESTRON

SECONDARY UNIT SUBSTATIONS

MEDIUM-VOLTAGE TRANSFORMERS

A. Subject to review by the Engineer with the Owner.

B. Medium-voltage transformers shall be Cooper.

C. Accessories:

1. One inch drain valve with sampling device.
2. Dial type thermometer.
3. Liquid level gage.
4. Two welded ground lug attachment points.
5. Pressure vacuum gage.
6. Provision for securing access doors in open position.
7. Pressure relief device, self-sealing with indicator.
8. Bay-O-net oil drip tray for each fuse.
9. One line electrical diagram stenciled in clear view when HV door is open.

11. Primary Terminations: Universal bushing wells to IEEE 386; provide six for loop feed. Include bushings for insulated load break elbow connectors.

D. Finish Color: Manufacturer’s standard Munsell Green.

26 1300 MEDIUM-VOLTAGE SWITCHGEAR

26 1321 AIR INTERRUPTER SWITCHES

26 1322 MEDIUM-VOLTAGE OIL SWITCHES

A. Subject to review by the Engineer with the Owner.

B. Medium-voltage switches to have concrete basements.

C. Medium-voltage switches to be Cooper RVAC switches.

D. Switches to have ground bar with clamps on each side.

E. Switches to have side hinged doors with pentahead bolt and padlock hasp on each side.

F. T-OP11 load break elbows on all 600 amp bushings.

G. All sources and tap connections shall have separate switches. All tap connections shall have ELSG fuse protection.

H. Surge Arresters: One (1) per each primary phase as shown on drawings.

I. Finish Color: Manufacturer’s standard Munsell Green

J. Load-Break Cable Terminators: Elbow-type units with 200-A-load make/break and continuous-current rating; coordinated with insulation diameter, conductor size, and material of cable being terminated. Include test point on terminator body that is capacitance coupled.

26 1839 MEDIUM-VOLTAGE MOTOR CONTROLLERS

26 2100 LOW-VOLTAGE ELECTRICAL SERVICE ENTRANCE

A. All service entrance into campus buildings shall be 480/277 volts.

B. Termination cabinets are not required.
C. All metering shall be in main switchboard and compatible with existing campus metering.

D. Dent Power Scout metering shall be used (PS3037-E-D)

E. Be sure all meters are properly installed per Manufacturers Requirements. Electrician is to verify new installations to assure proper installation of supplied components.

26 2200 LOW-VOLTAGE TRANSFORMERS

A. Sound Levels: Maximum sound levels: 30 dB for 45 or less KVA and 40 db for larger transformers as measured per ANSI C89.2.

26 2413 SWITCHBOARDS

26 2416 PANELBOARDS

A. When room numbers are changed panel legends need to be upgraded.

B. Each panel should be supplied with twenty percent (20%) spare capacity.

C. Provide spare conduits out of each recessed panel board to an accessible location above ceiling minimum spare conduits: 5 empty 3/4”.

D. Panelboard Bus: Cooper, ratings are required. Provide copper ground bus in each panelboard; provide insulated ground bus where required. Provide copper main and neutral lugs. Provide 200% neutral bus when needed.

E. Molded Case Circuit Breakers: Bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits. Do not use tandem circuit breakers. Provide copper lugs.

26 2419 MOTOR-CONTROL CENTERS

26 2501 LOW-VOLTAGE BUSWAYS

26 2501 LOW-VOLTAGE BUSWAYS - SCHNEIDER ELECTRIC I-LINE

26 2501 LOW-VOLTAGE BUSWAYS - SCHNEIDER ELECTRIC POWER BUS
26 2600  POWER DISTRIBUTION UNITS

26 2717  EQUIPMENT WIRING

A. Make conduit connections to equipment using flexible conduit. Use liquid tight flexible conduit with watertight connectors in damp or wet locations.

B. Make wiring connections using wire and cable with insulation suitable for temperatures encountered in heat producing equipment.

C. Provide receptacle outlet where connection with attachment plug is required. Provide cord and cap where field – supplied attachment plug is required.

D. Provide suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

E. Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.

F. Provide air tight seals in and around conduits and busway between inside and outside areas and in walk-in coolers and freezers.

G. All conductor connections to mechanical equipment shall be copper conductors.

H. MC Cable shall not be excessive in length. No coiling of cable.

26 2723  INDOOR SERVICE POLES

26 2726  WIRING DEVICES

A. Furnish at least 120-volt duplex outlet on each wall in each classroom and office and every 25 feet in corridors, and one outlet on each level in the stair towers.

B. Provide outside receptacle within 3 feet of downspout for heat tape.

C. Dual USB charging receptacle outlet to be as manufactured by Leviton model Power 2U or equal.

D. Provide receptacle outlets in equipment rooms for maintenance.

26 2813  FUSES

A. Fuses subject to review by the Owner.

   1. Main disconnect over 600 amps. Shall be class L – Current limiting type.
2. Main disconnect under 600 amps. Shall be Class RK-1 – Current limiting with rejection features.

3. Feeders to panels equipped with 10,000 A.I.C. circuit breakers.
   a. Up to 150 amps – Class RK-5.
   b. 175 amps through 600 amps – Class RK-1.

4. Feeders to power panels, motor control centers or transformers up to 600 amps. Class Rk-5.

5. Motors served from Fusible control centers, power panels or individually shall be protected by dual-elements fuses sized at 125% of actual nameplate rating.
   a. 100 amps or less – Class Rk-5.
   b. Over 100 amps – Glass RK-5.

26 2817  ENCLOSED CIRCUIT BREAKERS

26 2818  ENCLOSED SWITCHES

26 2913  ENCLOSED CONTROLLERS

26 2923  VARIABLE-FREQUENCY MOTOR CONTROLLERS

A. The frequency drives shall be ABB, Allen Bradley or Square D.

B. Installed VFDs must be capable to be bypassed in case of drive failure so the equipment can be run without the drive.

C. The drive fault must be setup to be reset from the front-end automation system.

D. VFDs shall be configured to restart automatically after a power outage/bump or after a building fire alarm has returned to normal.

E. VFDs are to be capable of BAC net MS/TP. Monitored and controlled points are listed in the Facilities Management standard controls specification.

F. Provide monitoring of VFD fault, start/stop, status, alarm and percentage of operation for each VFD.

G. Install VFD close to motor installation. Do not go over 50 feet for motor lead length.
H. Install an equipment grounding conductor throughout the VFD circuit. Provide a dedicated circuit for each VFD.

I. Provide a VFD stand-alone installation. No gutter or wiring is to be common to several VFD’s.

J. Install line, load, and control conductors in three separate raceways.

K. Automation controls should not be mounted inside VFD’s.

26 3100 PHOTOVOLTAIC COLLECTORS

26 3213 ENGINE GENERATORS

A. Subject to review by the Engineer with the Owner.

B. Install separate emergency lighting panel for all exit lights, fire alarm circuits, stairwell lights, and mechanical equipment spaces.

C. Self-powered units or auxiliary power source are necessary.

D. Generator (natural gas preferred) for life safety, condensate pumps, sump pumps, building automation and heating pumps.

E. Generator manufacturer must have service within 1 hour of location.

F. Emergency generators do not require programmable exerciser.

G. Power quality measures should be taken to protect equipment. It is Facilities’ recommendation to use UPSs, power conditioners and/or generator backup systems for all critical equipment and critical building systems where the department needs to maintain consistency with those systems or where necessary to protect equipment.

H. Non resettable hour meter

I. All generators shall meet the most correct emissions standards and regulations including but not limited to 40CFR63 subpart zzzz

26 3229 ROTARY CONVERTERS

26 3233 ROTARY UNINTERRUPTIBLE POWER UNITS

26 3305 BATTERY EMERGENCY POWER SUPPLY
A. Cathodic protection shall be installed to protect the steam distribution system from corrosion.

B. Interior light shall be mounted so the lamp can be replaced from a ten-foot stepladder. Fixtures that require special equipment, scaffolds, or other paraphernalia to re-lamp or service are to be kept to a minimum.

C. Minimum lighting used only for decorative purposes.

D. Energy efficient lighting to be installed.

E. All fixtures to be LED 4100K.

F. Lighting controlled by occupancy sensors wherever functionally feasible. The room lighting and HVAC controls are to work off the same occupancy sensor.

G. Occupancy sensors to control lights in offices, corridors and bathrooms. Lighting should not be shut off in stairwells. Stairwells to dim on unoccupied status. Labs, classrooms, lecture bowls and auditoriums to have light switches.

H. Provide adequate light in all equipment rooms.

I. Refer to ASHRAE 90.1 Lighting Control Standards
26 5113 LUMINAIRES, BALLASTS, AND DRIVERS

A. Consider dimmable drivers for LED fixtures

26 5537 OBSTRUCTION AND LANDING LIGHTS

26 5561 THEATRICAL LIGHTING

26 5600 EXTERIOR LIGHTING

A. Refer to ASHRAE 90.1 Lighting Control Standards

B. Parking Lot and Street Lighting: Use LED fixtures for outdoor lighting with photoelectric cells on-off control with override switch for maintenance. Fixtures are to match existing fixtures as approved by owner.

C. Walkway lighting shall be LED fixtures with photoelectric cell on-off control.