26 00 00 – ELECTRICAL

SECTIONS INCLUDED:

26 00 00 – ELECTRICAL (GENERAL) 26 10 00 – MEDIUM-VOLTAGE ELECTRICAL DISTRIBUTION 26 20 00 – LOW-VOLTAGE ELECTRICAL DISTRIBUTION 26 32 00 – PACKAGE GENERATOR ASSEMBLIES 26 50 00 – LIGHTING

26 00 00 – ELECTRICAL (GENERAL)

- Facility Services will provide information regarding preferred locations for tie-ins to existing utilities.
- Utility outages will generally need to be scheduled outside of normal working hours and will often include weekends and holidays. Discuss need for temporary power during outage with UNC FM. Specifications will need to include this requirement at no additional cost to the owner.
- Utilize a 277/480 VAC system for all new buildings where possible.
- Coordinate Training / O&Ms / Close-out with Section 01 70 00

DESIGN DATA

- Electrical designer shall provide a report indicating the complete load data for each project. Data to include total connected load, connected lighting load, connected mechanical load and other connected loads.
- Designer will also submit calculations of available fault current at all points within the electrical distribution system. Interrupt or withstand ratings that exceed the values determined in these calculations will be required for all electrical equipment specified in the design.
- For renovations / additions to existing systems, the design team shall provide for a 30 day load study (as required by NEC) to be performed during the design phase.

ELECTRICAL IDENTIFICATION

 Buried raceways shall be installed with suitable marker tape approximately 1' above the raceway.

- Paint covers of all boxes for fire alarm systems red.
- Provide arc flash labeling on all equipment, panel boards, switchgear, etc.
- Label all box covers with permanent marker indicating the circuits contained.
- Provide printed adhesive labels identifying circuit and panel feed on the face of all switch and receptacle covers.
- Use wire markers to ID circuits in junction boxes
- Label panel boards with engraved plastic nameplates indicating Panel designation, voltage, loads served. Nameplate to be mechanically fastened.
- Provide typed panel schedule in each panel and switchboard. Panel schedules shall provide specific information for each circuit indicating rooms or equipment served.
- Switches, starters and similar equipment shall be labeled with load served and source of power. Use engraved plastic nameplates.

OWNERS STOCK

- Spare Fuses Provide a minimum of three spare fuses of each size and type used. Provide a suitable spare fuse cabinet, mounted securely in a location designated by the owner. Specifically include fuses for high voltage equipment and transformers.
- Spare Light Fixtures Coordinate with Owner during design. Typically limit spare fixtures to specialized / highly decorative / unique fixtures. All other fixtures to provide spare LED Drivers as outlined below.
- Spare LED Drivers Provide 10% of each type / size used on the project. Label using fixture ID.

AS-BUILTS

 Emphasize the need for accurate / dimensioned / detailed red-line drawings for all underground site electrical conduits.

26 10 00 – MEDIUM-VOLTAGE ELECTRICAL DISTRIBUTION

MEDIUM VOLTAGE EQUIPMENT

- For most buildings medium voltage power will be connected to University owned distribution systems.
- The University primary system voltage is 12,470 VAC. Delta Primary, Wye Secondary.
- Transformers for medium voltage systems shall be exterior pad mounted equipment. Locate as directed by the owner. Transformers shall be non-PCB liquid cooled. Transformer size to be determined by the Engineer and reviewed by Facilities Management.
- All transformers to include internal switching capability with an "OFF" position to isolate the secondary.
- High Voltage sectionalizing switch gear for <u>West Campus</u> shall be pad mounted S&C PMH switches.
- High voltage switches for the <u>Central Campus</u> are incorporated into the transformers.
- High voltage cable shall be installed in UNC Tunnel System, and / or a concrete encased underground duct bank. Conduit in tunnel shall be galvanized rigid steel. Conduit in duck bank may be PVC type 1 or equivalent. Elbows shall be PVC coated galvanized rigid steel.
- High voltage cable shall be manufactured by Okanite. Okoguard Okoseal Type MV-105
- Load break elbow terminations shall be Elastimold #166LR and 655LR submersible, or approved equivalent
- Splices and lug type terminations shall be Elastimold or Ray-chem.
- Contractor shall provide HiPot testing of all new medium voltage cable.

26 20 00 – LOW-VOLTAGE ELECTRICAL DISRIBUTION

RACEWAYS / BOXES

CONDUIT

- Use EMT, Rigid and PVC in areas as required by code. Flexible conduit shall be limited to light fixture whips, and final connections to equipment.
- All conduit of any type must contain a ground wire.
- Provide minimum ³/₄" trade size conduit for all branch circuit homerun conduits to allow for potential future expansion. Verify with Owner for each facility.
- Fittings for EMT shall be steel compression gland or steel set screw type only.
- Provide conduits with pull wires for telecommunications use. Provide blank cover plates for all unused conduits.
- Conduits to be installed in floor slabs shall be approved by structural engineer. No conduit larger than ³/₄" trade size shall be installed in any floor slab.
- All elbows for PVC conduits shall be plastic coated rigid steel.
- Provide empty conduits with pull wires in all classrooms for projection equipment and control, instructors stations, TV and video equipment, ceiling mounted projectors, etc. Coordinate specific routing & size with UNC FM.
- Surface raceway shall be metal. Do not specify plastic products.
- Provide a minimum of 3 4", schedule 40 PVC conduits between the building and the nearest utility tunnel for telephone, data, TV, etc. Confirm size, quantity and location with Facilities Management.
- Provide warning tape buried above all exterior underground conduits and ductbanks.
- All site conduit to be 1" minimum.
- Provide 1" spare conduit with pull string from new building to site light poles and site J-Boxes.

BOXES

- Sectionalized type boxes are not permitted

UNIVERSITY OF NORTHERN COLORADO FACILITY DESIGN GUIDELINES

- Boxes for outlets, switches etc. shall be 4" x 4" minimum with appropriate mud ring.
- Coordinate access doors as required to provide access to boxes in hard ceilings and similar inaccessible areas. Type of access door shall be coordinated with the Architect.
- Do not allow back to back boxes.
- Site Junction Boxes shall be Polymer Concrete (aka Quazite) boxes. NO PVC Boxes allowed.

WIRE AND CABLE

- All conductors shall be copper. Use of aluminum conductors is not permitted. All conductors that attach to devices shall be solid conductors.
- Wire and cable shall generally be type THHN, THWN or THW
- Do not specify non-metallic cable (type NM or NM-C), Metal clad cable (type AC or MC)
- In no case shall conductor smaller than # 12 AWG be used for lighting or receptacle branch circuits. For branch circuits whose length from panel to the furthest outlet exceeds 100 feet for 120V circuits use # 10 AWG or larger.
- Wire or cable for specialized installations shall be as recommended by the Project Engineer
- Specify a grounding conductor in all branch circuit raceways.
- All circuits shall have separate neutral. Do not use handle ties.
- Color coding shall be as follows:

| VOLTAGE | A PHASE | B PHASE | C PHASE | NEUTRAL | GND |
|----------|---------|---------|---------|---------|-------|
| 120/208V | Black | Red | Blue | White | Green |
| 277/480V | Brown | Orange | Yellow | Gray | Green |

– Switch legs shall be separate colors from those identified above.

WIRE JOINTS AND CONNECTIONS

Joints in wires

- # 8 and smaller twist wires and secure with twist-on, expandable spring type solderless connectors with insulated shell
- # 6 and larger use solderless compression type lugs and connectors, insulated with half lapped layers of vinyl plastic electrical tape

WIRING DEVICES

- All wiring devices shall be specification grade (heavy-duty), suitable for high abuse locations, grounding type with separate grounding screw.
- Do not specify "Decora" style devices.
- All devices shall be designed for mechanical screw connection. Push in connections are not permitted.
- Lighting switches in mechanical rooms and similar locations shall be a lighted when off handle type switch.
- Devices shall be connected to a circuit with a pigtail from a splice. Do not wire the circuit directly through the device.
- Face plates for labs, food service, mechanical & electrical rooms, and similar spaces shall be 302 stainless steel. Face plates for residential, classrooms, offices, and public areas shall be nylon. Where two or more devices are shown in one location, mount under a common plate.
- Switches quiet operating, toggle operator, self grounding metal strap. Rated 20A at 120-277V.
- Duplex convenience receptacles shall be rated 20A at 125V AC.
- Devices to be ivory or white in color unless approved by owner. Special purpose outlets shall be color coded:
 - Emergency Red.
- Provide a welding outlet in each mechanical room located as directed by Facilities Management. NEMA 10-30R, 30 A, 125 / 250V

PANELBOARDS / SWITCHBOARDS

- Panels to be three phase unless otherwise approved by Facilities Management.
- Lighting and receptacle branch circuits shall be minimum 20 ampere.

- Provide a minimum of 4 spare 1" conduits out of each panel, routed to an accessible location.
- A/E to provide panel schedules on the contract drawings. Drawings and schedules shall be consistent with room numbering as provided by Facilities Management.
- All panels to have bolt-in breakers and hinged covers.
- All panels to be lockable, and keyed alike for each particular project.
- New panels shall be designed with a minimum of 30% spare capacity.
- Panel designation shall be by type ("L" 120/208V, "H" 277/480V, "E" Emergency Power), Floor (B / 1 / 2 / 3 / ect) and panel (A / B / etc.) ie: L2A, H3B, E1A
- Panels to be manufactured by Square D, Cutler Hammer, Siemens.

PANEL LOCATION

- Panels shall be located on the same floor as the load served.
- Panels are not to be located in custodial or other storage type spaces. Do not locate panels in laboratories, classrooms or behind doors. Locate in dedicated rooms wherever possible.

MAIN SWITCHROOM

- Main switchboard rooms shall not contain other systems or equipment not related to the electrical distribution system
- Specify filtered, thermostatically controlled ventilation for all main switchboard rooms.
- Provide battery powered of emergency lighting in all main switchboard rooms.

METERING

 All new buildings shall be individually metered with a switchboard mounted power monitor. Meter shall connect to UNC BAS for remote monitoring. Confirm communication protocol with UNC FM.

26 32 00 – PACKAGE GENERATOR ASSEMBLIES

- Cummins should start as basis of design. CAT is acceptable alternate
- 24 HR base tank required
- Provide emissions data during design for UNC's use in coordinating with CDPHE regarding impact on our Synthetic Minor Air Permit

26 50 00 - LIGHTING

INTERIOR LIGHTING

- All light fixtures shall be located so that they are easily accessible for re-lamping and maintenance activities. For example, do not locate ceiling fixtures over stairs or open light wells.
- All lighting design shall be based on the latest edition of IES Lighting Handbook
- Preferred lighting for classrooms, office, corridors and common areas is 2' X 2' lay-in fixture.
- UNC standard light color temperature is 4,000 K.
- Review switch groupings and / or use of dimmable fixtures at all office or classrooms with UNC FM.
- Review lighting control with UNC FM to confirm strategy for complying with IEEC / LEED requirements while utilizing proven technology.
- Exit Lights shall have green text.
- If emergency power is not provided by a generator, provide battery powered frog eyes emergency lighting. Do not specify standard light fixtures with emergency batteries.

EXTERIOR LIGHTING

 The outdoor pole light to be specified for use in campus <u>parking lots</u> is as follows: One or two head Metal Halide luminaires, on square straight steel poles (25 ft). Luminaire manufactured by Gardco. EH-19-1-3-250MH-277-SC-GTS-25-11-7-DI-SC-RAL 5003. Equivalent by Kim Lighting.(Designer to confirm voltage, lamp size etc.)

UNIVERSITY OF NORTHERN COLORADO FACILITY DESIGN GUIDELINES

- Design for 2.5 to 3 foot candles minimum in parking lots with a uniformity ratio of 4 to1.
- Lighting for walkways on <u>West campus</u> shall be as follows: Lumec 70MH-DMS50-SG3-277-CNI-IA-FB-SC-SM6-14-SC-RAL 5003. (12 ft poles may be appropriate for some locations.) Equivalent by Architectural Area Lighting.
- The decorative exterior pole lights in use for walkways on <u>central campus</u> are as follows: pole mounted luminaries with cast iron base, acorn globe with solid lid, 15 ft. cast iron pole, powder coat finish and stainless steel tamper resistant hardware. Antique street lamps Inc. by Lithonia Lighting. Product number: Holophane NY15/17-CIS/CM Pole, L_ _/5RSL9P_CM-S150/277 Luminaire. 40 watt LED Powder coat color RAL 5003 Sapphire blue.
- Design walkway lighting for 1.5 to 2 fc.
- Outdoor pole bases shall be 6" above finish grade in landscaped areas and 2' above grade where vehicular contact is possible. Coordinate concrete base detail and decorative collar with Facilities Management.
- Pole bases shall have one additional conduit stub out for future
- Outdoor lighting is to be controlled using RIB Relay's tied to the building automation system. Coordinate with DIV 23 controls specifications.
- Do not specify Bollard Lighting Systems
- Submit catalog information for owners review during design for all proposed light fixtures