PART 1 - GENERAL

1.1 RELATED SECTIONS:

See section 260573 Power Systems Studies for requirements related to short-circuit, coordination and arc-flash hazard analysis.

1.2 SCOPE OF SECTION:

This section contains the requirements for equipment and installation relating to the transmission, distribution, and control of electric power ranging from 601 to 15,000 volts; such as: substations, primary power cable, sectionalizing switchgear, transformers, and manholes. The Designer is required to utilize the latest revision of Electrical Guidelines and Policies, as published by the North Carolina Department of Administration, State Construction Office. Exceptions, additions, and modifications of the above referenced document are as noted within this section.

1.3 GENERAL:

A. The power system at ECU is composed of two distinct systems: the primary system at 12.47 kV and the secondary system at lower voltages typically 480 V 3 phase. The primary system is used to maintain service to electrical substations that step down primary voltages to secondary voltages. Substations are located around campus and form the nodes of the primary system that supplies electrical power to campus facilities.

B. For reliability, full redundancy is required for the primary distribution system.

C. System design shall ensure that the failure of any single component of the primary system will not prevent the system from carrying the full Campus load. Projects adding load to the primary system shall include upgrades to or expansion of the primary system to maintain this redundancy, as necessary.

D. New facilities shall be powered from the primary system. Each building shall have its own building service transformer(s).

E. Additions to existing facilities may be powered from the secondary system as appropriate. Existing secondary systems shall be upgraded to accommodate additional and future loads. Projects shall not “top out” existing secondary systems.

F. Overhead electrical distribution and transformers are not allowed.
1.4 PRIMARY POWER CABLE:

A. Projects are required to remove and replace duct banks to ensure conduit sizes are adequate and redundancy is provided. When new primary power cables utilize existing 4" duct, East Carolina University has been authorized by State Construction to allow Designers to specify 100 % insulation level (in lieu of the standard 133 % level) so that the NEC is not violated.

B. All cable ends shall be sealed to prevent the entrance of moisture into the insulation during shipment, storage, and installation.

C. Field testing of cables is to be performed in the presence of the Designer and the Owner’s representative. Contractor must provide a minimum of five (5) working days notice. Provide a certified copy of test results at the time of testing and with subsequent copies of the Operation and Maintenance Manuals.

D. Only qualified personnel shall do cable terminations and splicing. Qualifications of cable splicer to be submitted with cable submittals. Splices shall only occur within accessible manholes. At each splice and termination point, bond all shields, ground conductor, etc., to a ground rod or equipment ground system.

E. Arrange cables in manholes to permit subsequent installation of future cables in spare ducts and to permit repair and/or replacement of adjacent cables.

F. All cables shall be identified, at the point of entry into manholes or electrical equipment, with a plastic phenolic tag, minimum size 1” x 2” with 3/8” letters. Tags shall be attached with non-metallic, fungus-resistant, heat stabilized, nylon, self-extinguishing cable ties. Tags and attachment shall be verified with the Owner prior to procurement and installation. Tags shall indicate circuit origin, phase and destination when terminating at electrical equipment or at splices located within manholes or pull boxes. Cables that pass through manholes or pull boxes without splices shall only have circuit origin and destination information. In addition, at locations where phase indication is required, indication shall be by the use of color-coded electrical tape. Phase A is Black, Phase B is Red and Phase C is Blue.

1.5 SWITCHGEARS:

A. LOAD BREAK SWITCHES:

B. SECTIONALIZING SWITCHES:
1.6 **TRANSFORMERS:**

A. Transformers shall have all-copper windings.

B. Electric panels shall not be mounted inside or outside of transformer enclosures.

C. Dry-type transformers shall not be used on the exterior of buildings.

D. Manufacturer shall be an approved OEM; rebuilds are not acceptable.

E. All transformers shall be tested for winding resistance, transformer turns ratio (TTR), and oil dielectric. The test results shall be submitted to Designer and Facilities Services for review before transformer is energized.

F. Provide transformer with spare set of fuses.

G. All transformers shall have pressure/vacuum gauge, thermometer with resettable maximum reading indicator, and pressure relief device.

H. Transformers should be located so as to be visually unobtrusive. This is typically within a secured equipment service yard with bricked screen walls. Emergency generators are also typically located here. Coordinate location with Project Manager.

I. Transformers shall be turned over to Facilities Services with a minimum positive pressure of 2psi.

1.7 **MANHOLES:**

A. Minimum size shall be 8' X 8' with a minimum ceiling height of 96 inches.

B. Construction may be pre-cast reinforced concrete or can be cast-in-place. Entire structure shall be traffic rated per NC DOT standards.

C. Positively drain floor to a 12" X 12" X 12" sump pit.

D. Entire exterior shall be waterproofed with coating such as bituminous waterproofing mastic.

E. Locate pulling eyes opposite raceways.

F. Manholes shall be equipped with a traffic weight manhole ring and cover with the word “ELECTRIC” stamped clearly thereon. The lid shall be 30". All manhole covers shall be traffic bearing regardless of location.
G. All manholes shall have a driven ground rod, with a maximum resistance reading of 25 Ohms. Ground rod shall be Cad-welded to grounding conductor. Ground rod shall be connected to a fully closed loop of grounding conductor that is used to bond all splices and non-current carrying electrical equipment in manhole. Connections shall be made to racks with listed connectors suitable for the purpose. Loop of conductors shall be between 12" and 24" above floor and shall be securely attached to wall of manhole.

H. Cable in manholes shall be placed on porcelain insulators on suitable racks. Cable shall be secured by cable ties that are fungus resistant, ultra-violet and heat stabilized and are made of self-extinguishing nylon material.

I. Each cable shall be fireproofed, individually by phase, with a tape listed for the purpose, similar to Scotch brand #7700. Fire proofing tape shall be half-lapped and shall be installed into the conduit 1" or more. Fireproofing tape shall be binder wrapped with a glass cloth tape also listed for the purpose, similar to Scotch brand #27.

J. Length of any cable in manhole shall be not less than the circumference of the interior of the manhole. This dimension shall be determined, for a contiguous, unspliced length of cable, for the point where the cable enters the manhole to the point where it exits the manhole. For a length of cable that either splices or terminates within the manhole, the minimum length of one manhole circumference shall be determined from the point where the cable enters, or exits, the manhole to the splice or termination.

K. If the newly installed cable is to be connected to an existing cable, within the manhole, the newly installed cable shall have a length of not less than one circumference of the manhole from the point where the cable enters, or exits the manhole, to the point of connection to the existing cable. The existing cable shall not be required to be one manhole circumference if that amount of length is not existing. However, the existing cable shall not be shortened without authorization from the project manager based on written permission from the appropriate Maintenance Manager.

L. Maximum distance between manholes shall be 200 feet.

M. Pre-cast manholes shall have end belles installed at factory. Provide a minimum of two (2) 5" end belles per wall.

N. All penetrations in manholes shall be watertight.
1.8 **PULL BOXES:**

Pull boxes shall not normally be used.

END OF SECTION