

STATE UNIVERSITY CONSTRUCTION FUND

PROGRAM DIRECTIVES

DIRECTIVE 16-7

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CAMPUS ELECTRIC DISTRIBUTION SYSTEMS

1. General
 - a. Campus electric distribution systems shall be designed to provide a high degree of reliability, safety, and continuity of service. Special design features such as dual-selective feeders and double-ended switchgear shall be provided when required by the Campus Master Plan or the Project Program.
 - b. New or reconfigured systems shall be grounded
 - c. Working in live manholes is permitted except for cutting of existing feeders.
2. Cable Construction (Over 600 Volts)
 - a. Single conductor, EPR (Ethylene-propylene-rubber) or Kerite insulated, shielded power cables rated MV-105. (Cross-linked polyethylene insulation or lead shall not be used.) Cable shall comply with the following:
 1. AEIC CS8 for Ethylene Propylene Rubber Insulated Shielded Power Cables (does not apply to Kerite).
 2. ICEA Publications S-93-639 and S-97-682 and NEMA Publication WC74 for Ethylene-propylene-rubber insulated wire and cable.
 3. UL Standard 1072 for Type MV-105.
 4. Certified Test Reports may be required.
 - b. Conductor: Uncoated copper, compact stranded per ASTM B-496. Provide aluminum conductors at University at Buffalo-North Campus only.
 - c. Conductor shielding: An extruded semi-conducting material must be imposed between conductors and insulation. Shield shall meet or exceed electrical and physical requirements of ICEA S-97-682, AEIC CS8, and UL 1072.
 - d. EPR or Kerite insulation over conductor shielding. EPR insulation shall meet requirements of ICEA S-97-682, AEIC CS8, and UL 1072.
 - e. Insulation shield: Extruded semi-conducting thermosetting compound applied over the insulation. Shield shall meet or exceed the electrical and physical requirements of ICEA S-97-682, AEIC CS8, and UL 1072. The shield shall be free-stripping, leaving no residue on the insulation surface.

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- f. Copper tape shield: Helically applied, 5 mil uncoated copper shielding tape, with a minimum 12.5% lap applied directly over extruded insulation shield. Provide concentric-neutral URD cables at University at Buffalo-North Campus only.
- g. Cable jacket shall be PVC.
- h. Cables shall be manufactured and tested under a quality assurance program that meets the requirements of Section 10 CFR50, Appendix B, of the Federal Register as defined in ANSI N45.2.
- i. All cable shall be identified by means of surface ink printing indicating manufacturer, size, insulation type, insulation thickness, voltage rating, insulation level, year of manufacture, and UL designations.
- j. Cable Insulation Ratings:

<u>System Voltage</u>	<u>Insulation Thickness</u>
2400 V and 4160 V	115 Mils
4.8 KV, 12.47 kV, 13.2 kV, and 13.8 kV	220 Mils
23 KV through 34.5 KV	345 Mils

3. Cable Installation

- a. Use pulling eye attached to conductors.
- b. Manufacturer's maximum pulling tension shall not be exceeded. Fund representative shall monitor dynamometer.
- c. A grounding conductor shall be provided with each feeder to serve as a ground return path.
- d. Arc-proofing: Show on drawings the extent of arc-proofing. Provide in all manholes and inside buildings where cables are run exposed.
- e. Cable Testing
 - (1) Specify DC high potential testing on new cable after installation, but prior to connection to existing cable, by an independent, INETA certified testing firm.
 - (2) Do not HiPot test existing cable. Megger testing may be done.
 - (3) Use manufacturer recommended test voltages.

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- (4) Test ground back to source.
- (5) Maintain phase rotation and sequencing throughout to allow momentary closed-transition switching between dual-radial feeders.
- f. Manufacturers: Consultant shall investigate manufacturers for inclusion in the specifications and be prepared to submit background data that qualifies each manufacturer specified. A minimum of three (3) manufacturers should be listed.
- g. Identification
 - (1) Ductbank: Provide a metallic-lined, plastic underground marker tape over concrete ductbank. The tape shall contain the printed identity of the duct repeated continuously along its length.
 - (2) Feeders: Provide engraved nameplates attached to feeders in manholes and terminations. Include manufacturer, size, insulation type, conductor type, insulation thickness, voltage rating, insulation level, year of installation, and feeder designation.
 - (3) Identify rooms with services over 600 Volts with **“Danger - High Voltage – Keep Out”** warning signs.
- h. Delivery and Storage
 - (1) No cable over one year old, when delivered to site, shall be used.
 - (2) Store at optimum temperature for installation in dry location. Seal cable ends against moisture.
- i. Splices and Terminations
 - (1) Premolded, separable splices and terminations preferred.
 - (2) Electricians shall be experienced in type of splices used. Resume and certification to be submitted.
 - (3) Ground shield at splice.
 - (4) Provide fault indicators where needed to aid in locating faults.
- j. Procedure for Cutting Existing Feeders in Electric Power Manholes
 - (1) Comply with OSHA requirements and Campus procedures.

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- (2) Cut cable using remote cutting head. No personnel are to be in manhole or electric room during cutting, in case the feeder is inadvertently live.
- k. Ductbank and Manhole Design (Refer to Directive 2-3 for more information.)
- (1) Size: Manholes must be adequate for new and future work and for safe clearances for working. Minimum size 5' by 7' by 7' high.
 - (2) All manhole structures shall be waterproofed with an externally applied 60 mil bituminous coating. Manhole covers shall be gasketed.
 - (3) Five-inch PVC conduit is preferred. Conduit is to be encased in reinforced concrete. Avoid conduit sizes in the "jam ratio" for three-conductor feeders, where possible.
 - (4) Duct Shear: Extend ductbank reinforcement into manhole and building walls to prevent shearing of ductbank.
 - (5) Existing Underground Ductbanks and Manholes: Existing underground conduits and manholes shall be surveyed prior to design manual phase and a report submitted to SUCF. The report should note dimensions, duct arrangements, and describe grounding, splicing, arc-proofing, ductbank shear, racking, drainage conditions, etc. Rehabilitation of detrimental existing conditions shall be included in the project scope.
 - (6) Where duct banks cross or are close to underground steam or hot water pipes, the ductbanks shall be insulated to mitigate thermal conditions beyond the cable safe operating temperature range.
 - (7) The Consultant shall update the campus one-line power distribution diagram at the completion of the modifications.
