DIRECTIVE 16-7  

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.
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:

<table>
<thead>
<tr>
<th>System Voltage</th>
<th>Insulation Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>2400 V and 4160 V</td>
<td>115 Mils</td>
</tr>
<tr>
<td>4.8 KV, 12.47 kV, 13.2 kV, and 13.8 kV</td>
<td>220 Mils</td>
</tr>
<tr>
<td>23 KV through 34.5 KV</td>
<td>345 Mils</td>
</tr>
</tbody>
</table>

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.
(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 OHSA requirements and Campus procedures.
(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.

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