26 10 00   Medium and High Voltage Electrical Distribution

1. **Source of Power and Substation**
   1.1. All new buildings will require a unit substation fed at 4160V from the existing campus grid. This substation shall be indoors unless special permission given by PPS.

   1.2. Only in exceptional cases will the power be supplied at secondary voltage from an adjacent building. The connection to the existing 4160V power distribution network shall be specified by PPS.

   1.3. Flexibility is maintained through the use of network switches, multiple cables to each building and cross connections of the cable through network switches.

   1.4. Phasing is marked from left to right or top to bottom Red-Yellow-Blue, Red-White-Blue, or A-B-C.

2. **Buried Services and Duct Banks**
   2.1. Location of all 4160V cables in duct shall be marked with brass markers either supplied by Queen’s or to Queen’s Standard Design. A sufficient number of these markers is to be arranged to allow the cable route to be easily determined. Direct buried cables are not acceptable.

   2.2. New or changed underground services shall be recorded on the digital campus map and on the 5kV operating diagram as well as on the design drawings associated with the project (if applicable).

   2.3. All concrete encased buried electrical power duct banks shall be installed according to the latest Ontario Electrical Safety Code and Ontario Provincial Standard Drawings.

3. **Transformers – Dry Type 5kV**
   3.1. Transformers shall be three phase, indoor, dry type with copper windings and have 220 insulation class and 115°C temperature rise. Transformers may be liquid-filled if to be located outside and will require approval by Queen’s PPS.

   3.2. The primary shall be delta-connected, rated 4,160V and a Basic Impulse Level (BIL) of 60kV minimum. Four taps shall be provided; 2 at 2 ½% full current above nominal (FCAN), 2 at 2 ½% full current below nominal (FCBN). Normally the primary taps will be set at 97 ½%.

   3.3. For a newly-constructed/renovated building the secondary voltage shall be wye-connected at 600/347V, three phase, four wire, and grounded neutral. 208/120V
distribution shall be provided locally as required throughout the building. For partial renovations, the secondary voltage of the 5KV transformer can also be 208/120 V. System design shall be reviewed and approved by PPS.

3.4. The transformer capacity shall be double the designed operating load (not connected load) and shall include for the installation for at least four vehicle chargers.

3.5. Transformers shall be provided with Qualitrol winding temperature indicators complete with remote terminals and shall be connected to a remote monitoring system.

3.6. PPS shall be provided with appropriate data for updating the 5kV operating diagram and the 5kV computer model.

3.7. PPS shall be provided with complete nameplate data to be entered in the 5kV transformer (TR) database and the PPS maintenance database.

3.8. The transformer shall be identified according to Queen’s naming convention and shall be identified with a nameplate manufactured to Queen’s Standards.

3.9. A disconnecting device for the transformer shall be located within the same room unless approved by Queen’s PPS.

3.10. Documentation for transformers shall include manufacturer’s catalogue cuts, recommended operating and maintenance instructions and warranty information, and shop drawings.

4. **Network Switches – 15kV**

4.1. 15kV network switches are used on campus to interconnect the 4160V grid. New switches are SF6 insulated and are manufactured by G&W Electric Limited. The requirement and configuration for a switch shall be determined by PPS. (15kV switches are used because 5kV switches are no longer manufactured.)

4.2. Network switches shall include test positions to facilitate grounding of connected cables. Each network switch shall be supplied complete with three (3) Cooper Power System LPC-215 deep-well bushing insert kits and three (3) Cooper Power System LPC-215 protective caps. The inserts and caps shall be installed prior to network switch commissioning.

4.3. SF6 network switch shall have a valve before the SF6 pressure gauge which would allow the isolation of the gauge from rest of the SF6 chamber.
4.4. New added SF6 network switches shall have analog SF6 pressure sensor connected to building automation system.

4.5. Network switches are assigned PPS identification numbers (NS numbers). Nameplates shall be manufactured to Queen’s standard and fastened to the front of the network switch.

4.6. Complete nameplate data must be provided to PPS to enter in Queen’s NS database.

4.7. Documentation shall include manufacturer’s operating and maintenance instructions, specifications, data sheets and shop drawings.

4.8. SF6 network switch shall have a valve before the SF6 pressure gauge which would allow the isolation of the gauge from the rest of the SF6 chamber.

4.9. New added SF6 network switches shall have analog pressure sensor connected to building automation system.

5. **Primary Switchgear Assembly – 5kV**

5.1. Primary gear shall not include metering, breakers or special control equipment unless approved by PPS.

5.2. Switchgear shall be rated to withstand the available fault energy estimated by Utilities Kingston to be 150 MVA.

5.3. The insulation rating of all 5kV class primary supply equipment shall have a Basic Impulse Level (BIL) rating of 60kV minimum.

5.4. Each substation transformer shall be provided with a fused, load break switch rated at 600A, 5kV minimum. Clearly visible potential indicators shall be provided on each phase of the line and load side of the switch and shall be viewable via factory-installed windows.

5.5. Isolation switches shall be manufactured and supplied by S&C Electric. Neither used nor reconditioned nor old stock equipment may be used without the express permission of PPS. Power fuses shall be refill type SM-5 as manufactured by S&C. The refill current, voltage and time current rating shall be specified in conjunction with PPS.

5.6. Isolation switches (IS) are assigned PPS identification numbers. Associated data must be provided to PPS to enter in Queen’s IS database.

5.7. Documentation shall include manufacturer’s operating and maintenance instruction, specifications, data sheets and shop drawings.
6. **Motor Starters**

   6.1. Motor starters shall be NEMA rated.

   6.2. 5kV motor starters shall be equipped with digital electrical metering as specified in section 26.242.5.

   6.3. All three phase motor starters must be equipped with protective devices that will disconnect the motor completely from the supply in the event of an overcurrent or sustained overload condition and prevent single phasing.

   6.4. Solid state motor starters shall have proper temperature, overcurrent and overvoltage protection included in the design. The starters shall be shipped with proper fuses installed. The fuses selected shall be based on actual tests of fuses in series with the semiconductors. Overvoltage protection shall be voltage breakover clamping inherent in the starter design.

   6.5. Motor status shall be acquired using current switches and not by using auxiliary contacts.

   6.6. Documentation shall include manufacturer's catalogue data, shop drawings, manufacturer's replacement parts list, operation and maintenance data.