D 5030 – ELECTRICAL DISTRIBUTION

1. General

1. All buildings to have dedicated service room for service entrance electrical equipment. This applies to power and communications.

2. Service Voltages on campus are

   .1 Primary: 13.8 kV 3 Phase
   .2 Secondary: 347/600 Volts, 3 Phase, 4 Wire
                  120/208 Volts, 3 Phase, 4 Wire
   .3 For risers in new installations 347/600 Volts, 3 Phase, 3 Wire

2. 15KV Primary

1. All 15KV primary switchgear is supplied by the Campus Utility for installation in new construction. Charges related to switchgear supply are borne by the project.

2. All 15KV primary power cable is supplied by the Campus Utility. Cables are generally 15KV 3 conductor #2/0 AWG copper MV Teck cable. Cables are installed by Division 16 and terminated by the Campus Utility.

3. Utility Metering

1. Coordination with Others

   .1 Space allowances and metering cubicle spaces to be coordinated and approved by University of Alberta Utilities prior to fabrication of equipment.

2. Utility Metering Cabinet

   .1 Surface mounting code gauge metal construction with hinged locking door with catch 762 mm x 762 mm x 250 mm deep.

   .2 CT’s and PT’s for utility metering will be supplied and installed by Division 16. CT’s and PT’s shall be revenue metering accuracy. Potential transformer shall be ABB Type VIZ-11 with GE EJ-1 fuses. No substitutions. Potential transformers to be mounted in a drawout drawer. Provide 3 PT’s and 3 CT’s for each side of the double ended substation for connection in grounded wye configuration on each side.
3. Revenue Meter (2 required)

.1 The revenue meter to be 3-phase, 4 wire, three element General Electric Type KV Time of Use (T01) electronic meter.

.2 Metering installation shall conform to metering standards available from the University of Alberta.

4. Coordination

.1 From each metering cubicle provide one 35 mm empty conduit to meter cabinet. Install pullwire in conduit.

.2 The University of Alberta will supply and install all wiring from the 15 kV switchgear to the meter cabinet and terminate at the meter.

.3 From the meter cabinet provide one 21 mm conduit to cable tray for data cable connection from Utility meters to UCMS monitoring system.

4. Co-ordination Study

1. Scope: In addition to the equipment provided with this contract for the coordination study, it shall also include the existing U of A protection that is upstream of this installation.

2. Time Current Curves: Include with the drawing submission for the main and secondary distribution switchgear and MCC’s, a complete set of time-current characteristic curves and instruction booklets for all manufacturer’s overcurrent devices including: fuses, overcurrent relays, overload relays, molded case circuit breakers, power air breakers having integral relays, damage curves for transformers, accuracy classes and burden’s for CT’s and VT’s. The time current curves will be used in the Coordination Study.

3. Coordination Study: Provide a detailed coordination study of all distribution equipment substantiating the settings by illustrating upstream and downstream equipment. Plot curves on full log-log 11 by 17 graph paper to 600-volt base. Show ANSI cable damage curves and transformers damage curves for transformers 112 kVA and larger. Transformer inrush and FLA at ONN and ONAF rating (where provided), large motor starting curves for motors over 112kW. Plot the available three phase and single phase (line to ground) fault short circuit currents. This may require a short circuit study to determine this data. Provide a single line depicting protection illustrated with each log-log sheet.
4. Submission and Approval: Coordination study submission shall be accompanied with the individual time-current curves of each device to enable the Consultant to verify the ratings and settings selected. Submission and approval will verify the ratings and settings of all protective devices. Approval will not eliminate the responsibility of the contractor to provide proper coordination. Curves must be accompanied with a seal from a practicing P. Eng. or RPT (Eng.) Licensed with APEGGA.

5. Pre-Final Inspection: Division 16 to arrange for switchgear manufacturer to visit the site to check all settings to ensure they are in accordance with the coordination study.

6. Commissioning:

   .1 The Construction Manager or his assigned representative or testing agent shall implement the settings as indicated in the coordination study in the event that errors are discovered data that shall be forwarded to the switchgear manufacturer and necessary revisions made to the coordination study and/or equipment as required to provide proper coordination.

   .2 Cost for the preparation of Coordination Study to be by Division 16.

   .3 The Construction Manager shall provide one copy of the Coordination study and setting summary sheet for use by the Commissioning Facilitator.

5. Arc Flash Study and Deliverables

   .1 Scope: In addition to the coordination study listed above an arc flash study shall be performed for each project. The reason behind and the basis for this study is developed in NFPA-70E and has been further enhanced by the issue of its Canadian Analogue CSA-Z462, it is the intent that the arc flash study will be executed using the same software system under which the coordination study data was input into.

   .1 As outlined in the aforementioned standard Z462 data on hazard intensity / PPE requirements / labels will be provided for the use of the University in the operation and maintenance of each facility / system.
.2 Cost for the preparation of Arc Flash Study to be borne by Division 16 Consultant under the fees for services for each electrical power systems design.

.3 Labelling data for various components of the electrical system will be generated by the Arc Flash Study as part of the work of the Design Consultant (or his sub-contracted representative). The labeling information shall be generated out of the electronic coordination study software such as SKM and will be given in both soft copy and hard copy to the University for use and for the project record.

.4 The designer or firm contracted to perform the Coordination/Arc Flash Study shall provide one hard copy of the Arc Flash Study and corollary information such as equipment label data for use by the Owner and or the assigned Commissioning Facilitator. This will be in addition to copies required by each project for the O&M data submission(s) and that under 5.1..3 above.

6. Power Transformers

.1 Step down power transformers from 13.8 KV to 347/600 Volts, 3 Phase, 4 wire are to be of high efficiency cast coil design. VPI transformers are not acceptable to the Utility on campus.

.2 Transformers to be sized to 70% demand load when single transformer is used and sized for 50% connected load when two transformers are used.

7. Power Factor Correction / Harmonics Correction

.1 Power factor correction and limited harmonics mitigation are provided by the Campus Electrical Utility. Provisions for the connection of power factor and harmonic correction equipment are required to be designed into the main 600V (or 208V) building power distribution system.

.2 It may be that a single connection can be provided to connect both the power factor and harmonics correct equipment. Depending on the manufacturers involved it may also be required that 2 circuit breaker connection points might be required. As such in main-tie-main service configurations as many as 4 circuit breaker positions in the main distribution line-up might have to be provided if separate breakers were to be required for power factor correction and harmonic filtering on each side of the tie breaker.
8. Main Secondary Distribution

.1 On projects where connected load exceeds 2 MVA and dual primary distribution is selected, the secondary distribution to incorporate main-tie-main design with automatic transfer and remote control capability from Utilities Automation Control.

.2 Distribution bussing to be sized for full capacity of the transformer plus 40 percent to nearest bus size. All distribution bussing to be copper.

.3 All breakers 1000 Amp and larger shall be drawout type, industrial air circuit breakers or insulated case breakers.

.4 All main distribution centres to incorporate TVSS on load side of main breaker.

.5 All main distribution centres to incorporate digital metering supplied as an integral part of the main breaker and feeder breakers where feeder breakers are 800 amp or larger.

9. Subdistribution

.1 All subdistribution, CDP’s, panelboards to be breaker type. Fusing not permitted. Breaker fault levels to be compatible with main secondary distribution.

.2 All CDP’s and panelboards should be supplied with door-in-door construction.

.3 Series rated breakers not permitted.

.4 Maximum fault level on 347 volt lighting panelboards is 14KA. (Confirm based on values derived from Coordination Study for predicted kAIC availability – final value may need to be higher than the 14 kA listed above)

.5 Maximum fault level on all 120/208 volt panelboards is 10KA. Confirm based on values derived from Coordination Study for predicted kAIC availability – final value may need to be higher than the 10 kA listed above)

9. Secondary Distribution Transformers

.1 Transformers to be high efficiency (98.5% or better) copper wound and K rated where necessary to suit the application. Transformers shall meet at a minimum CAN/CSA 802.2 – 06 standard for efficiency
.2 Transformers to be Type ANN, 600/208/120 volt, 60 Hz, delta primary, electrostatic shielded grounded star secondary, air cooled type, copper wound, vacuum pressure impregnated high temperature polyester epoxy, natural circulation in ventilated enclosure, Class H, 220°C insulation with temperature rise not exceeding 115°C maximum in 40°C ambient.

.3 Provide four primary 2.5% full capacity taps, two above and two below nominal voltage. Voltage regulation at 4% or better.

.4 Transformer impedance to be between 4.0 and 4.5 percent for units 225 KVA and smaller.

.5 Transformer impedance to be between 5.0 and 6.0 percent for units larger than 225 KVA.

.6 Phase shift or zig zag transformers to be utilized where large portion of building load is computer based with the expected large harmonic loading component.

.7 Scott-T connected style transformers not permitted.

10. Transient Voltage Surge Suppression

1. Standards

Units shall be designed, manufactured, tested and installed in compliance with the most recent publication of the following standards:

- ANSI/IEEE C62.41
- ANSI/IEEE C62.45
- CSA
- NEMA
- UL Standard 1449

Submit UL 1449 listed voltage ratings for each model.

2. Electrical Requirements

.1 System Voltage: 120/208 volts, 3 phase, 4 wire grounded wye or 347/600 volt, 4 wire grounded wye as shown on the drawings.

.2 Maximum Continuous Operating Voltage of all Suppression Components:

- 125% of facility’s nominal operating voltage for 120 volt systems.
- 115% of facility’s nominal operating voltage for 220, 240, 277, 347 and 600 volt systems.
.3 Operating frequency: from 50 to 62 Hz.

.4 Protection Mode: The unit shall provide protection on wye configured systems for:

- line to neutral transients.
- line to ground transients.
- Neutral to ground transients.

.5 Repetitive Surge Current Capacity: Based on ANSI/IEEE C62.41 standard 8 x 20 microsecond current waveform, the maximum repetitive surge current capacity of the unit shall be no less than:

<table>
<thead>
<tr>
<th>Mode of Operation</th>
<th>Main Panelboard</th>
<th>Main Switchboard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line to Neutral</td>
<td>125,000 amp</td>
<td>50,000 Amp / Phase</td>
</tr>
<tr>
<td>Line to Ground</td>
<td>125,000 amp</td>
<td>50,000 Amp / Phase</td>
</tr>
<tr>
<td>Neutral to Ground</td>
<td>125,000 amp</td>
<td>50,000 Amp / Phase</td>
</tr>
<tr>
<td>Surge Current per Phase</td>
<td>250,000 amp</td>
<td>100,000 Amp / Phase</td>
</tr>
</tbody>
</table>

.6 Performance Rating: The performance suppression rating for the unit should be as published by UL 1449. SVR UL 1449 shall be no greater than 400 volts.

.7 Life Expectancy: The unit shall be capable of protecting against and surviving at least 2000 ANSI/IEEE C62.41-1991 Category C surges without failing or degrading the UL 1449 surge suppression rating by more than 10%.

.8 Protection: Unit shall incorporate integral replaceable overcurrent rise protection.

3. Acceptable Manufacturers

.1 Current Technology – TG250-3G4-L1
.2 Liebert
.3 Tycor International
.4 United Power
.5 Transtector – AEG15 SP225.

4. Installation

.1 Install units at main distribution centre and designated panelboards.
.2 Where units are mounted integral with switchgear, status LEDs shall be visible without removing covers or opening doors.

END OF SECTION