1. GENERAL

1.01 SECTION INCLUDES

.1 Provide a short circuit and coordination study for the new portions of electrical distribution system. The basic analysis shall include a protective device evaluation, and a protective device coordination study.

.2 The project shall begin at the point of utility service for the facility and continue down through the system to all downstream distribution and branch panelboards, motor control centres and significant motor locations.

.3 The project shall include any new generators and any associated emergency power distribution equipment, including automatic transfer switches and generator ground fault protection.

1.02 RELATED REQUIREMENTS

.1 Section 26 05 73.19 – Arc-Flash Hazard Analysis.

.2 Single Line Diagram.

1.03 REFERENCE STANDARDS

.1 Perform all studies in accordance with the latest applicable IEEE and ANSI standards.

.1 ANSI C38.010-1999.

.2 ANSI C37.5-1979.

.3 ANSI C37.13-1990.

1.04 SUBMITTALS

.1 In accordance with Section 01 33 00:

.2 Submit the following:

.1 Submit for review three copies of the protection coordination study.

.2 Shop drawings for equipment affected by the coordination study will not be reviewed until the coordination study has been submitted and reviewed.

.3 Include a one-line diagram of the system.

.4 Bind the final report in a three-ring binder, as well as a soft copy.

.3 Projection System Coordination:

.1 Prepare a graph or coordination curves, prior to manufacture of service entrance and distribution equipment on K & E No. 336E Time-Current characteristic graph paper. Time-current characteristics shall be plotted of the following:

.1 Supply Authorities relays or fuses protecting incoming service (Contractor under this section shall obtain this information).

.2 Main and feeder protective devices at every voltage level used in distribution system.

.3 Protective devices associated with largest motor and/or refrigeration compressor.

.2 Preliminary submission of graph for comment will be accepted. Submit graph to Supply Authority for approval by them as providing satisfactory co-ordination. When curves have been approved by Supply Authority, they shall be submitted for approval. After approval has been obtained, order protective devices, and calibrate to conform with these curves.

.3 Each time-current characteristic curve sheet shall include:

.1 A single line diagram for the portion of the system involved.

.2 Transformer damage curves (where applicable).

.3 Cable damage curves (where applicable).

.4 Available fault levels for the portion of the system involved.

.4 Consult manufacturer of the refrigeration compressors and obtain recommendations for settings on starters. Incorporate information in co-ordination curves and submit the associated curves to Compressor Manufacturer and obtain approval from the manufacturer.

.5 Compressor manufacturer and mechanical trade contractor will determine and calibrate proper protection on motor starters and will ensure that it coordinates with protective devices on switchboard.

.6 Co-ordination curves, mentioned above, shall be prepared by distribution equipment manufacturers as soon as possible after award of contract.

.7 At the option of this contractor under this section, these co-ordination curves may also be prepared by an independent testing organization. In this case, the independent testing organization shall determine the proper settings of all protective relays and devices and pass them on to the switchboard manufacturer for incorporation into the switchboards. Include all associated costs in the tender.

.8 Distribution Equipment manufacturers shall examine drawings and specifications prior to award of contract to ensure that relays and devices being supplied by them will co-ordinate satisfactorily to Supply Authority requirements. Payment will not be allowed, after award of contract, for extra charges due to device changes to comply with recommended practices, due to oversight or negligence by distribution equipment manufacturers.

1.05 CLOSEOUT SUBMITTALS

.1 The Engineer who prepared the report shall visit the site and confirm that the feeder sizes as installed are consistent with the report as submitted.

.2 Submit final version of the report with as-constructed feeder lengths and feeder sizes.

1.06 QUALITY ASSURANCE

.1 Preparer Qualifications: Firm experienced in the analysis, evaluation, and coordination of electrical distribution systems and similar to the system for this project.

.2 The study shall be prepared in accordance with the latest edition of NETA ATS, the Canadian Electrical Code, as well as manufacturer's recommendations.

.3 Short-Circuit Analysis and Coordination Study shall be performed by a registered Professional Engineer. Study shall be signed and sealed by the Engineer. The Engineer shall have a minimum of eight years experience in the analysis, evaluation, and coordination of electrical distribution systems.

.4 The firm conducting the study shall have one million worth of Professional Liability Insurance in addition to standard general insurance.

2. PRODUCTS

2.01 MANUFACTURERS

.1 Independent Testing Organizations

.1 AC Tesla.

.2 Brosz and Associates.

.3 C-INTECH.

.4 Eastenghouse.

.5 Enkompass.

.6 G.T. Wood.

.2 Electrical distribution manufacturers:

.1 Eaton.

.2 Schneider Electric.

2.02 PROTECTIVE DEVICE COORDINATION STUDY

.1 Prepare coordination time-current characteristic curves to determine the required settings/sizes of the protective devices to maximize selectivity. The utility upstream protective device feeding the facility shall be maintained as the upper limit for coordination. These settings shall be obtained by the preparer, along with any other protective device setting requirements. The coordination curves shall be prepared on log-log paper and illustrate adequate clearing times between series devices. The curves shall be created through the use of the study software package, but must reflect actual protective devices to be installed. Adequate time-current curves shall be generated to depict coordination. In addition, protective device characteristics shall be suitably determined to reflect calculated short-circuit levels at the location.

.2 A narrative analysis shall accompany each coordination curve sheet and describe the coordination and protection in explicit detail. All curve sheets shall be multi-colour for improved clarity. Areas lacking complete coordination shall be highlighted and reasons provided for allowing condition to remain or provide solution to resolve situation. System coordination, recommended ratings, and setting of protective devices shall be accomplished by a registered professional electrical engineer with a minimum of eight years of current experience in the coordination of electrical power systems.

.3 The following information shall be provided on all curve sheets:

.1 Device identification and associated settings/size.

.2 Voltage at which curves are plotted.

.3 Current multiplier.

.4 ANSI frequent fault damage curve.

.5 Cable insulation damage curves.

.6 Transformer inrush point.

.7 Single-line for the portion of the system.

.8 Motor starting profiles (where applicable).

2.03 SINGLE LINE DIAGRAM

.1 The final report shall include a multi-colour single line diagram of the electrical distribution system within the scope of the project. The single line diagram shall include:

.1 Transformer rating, voltage ratio, impedance, and winding connection.

.2 Feeder cable phase, neutral and ground sizes, length of cable, conductor material, and conduit size and type.

.3 Switchgear, switchboards, panelboards, MCC's, fuses, circuit breakers, ATS's and switches continuous current ratings.

.4 Protective relays with appropriate device numbers and CT's and PT's with associated ratios.

.5 Detailed legend indicating device type identification and other significant details.

3. EXECUTION

3.01 EXAMINATION

.1 Obtain fault level and X/R ratio information from the utility.

3.02 SUMMARY

.1 The results of the system studies shall be summarized in a final report.

.2 Where required, copies of the final report shall be submitted to the Supply Authority for their review and approval. Submit approved copies of the report to the Consultant.

3.03 ADJUSTING

.1 The contractor shall engage the manufacturer's service group or alternately a qualified independent testing firm to perform field adjustments of the protective devices as required for placing the equipment in final operating condition. The settings shall be in accordance with the approved short circuit study and protective device evaluation / coordination study.

.2 Necessary field settings of devices and adjustments and minor modifications to equipment to accomplish conformance with the approved protective device coordination study, shall be carried out by manufacturer's service group.

.3 Submit a final service report confirming that settings have been completed.

End of Section