KISSIMMEE UTILITY AUTHORITY
Engineering and Operations Department

KUA KISSIMMEE UTILITY AUTHORITY	**PLANNING DOCUMENTS**	**Document No.** PL.41.100.10.00		**Prepared By** M. J. Simpson
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DESIGN CRITERIA FOR INTERCONNECTION SUBSTATIONS

GENERAL. This document covers the design criteria to be used for substations associated with the interconnection of transmission facilities. It covers both 230 kV and 69 kV facilities. This document is intended to give general design criteria. Actual designs, equipment specifications, bills of material, etc. shall be submitted to KUA for review and approval before proceeding with procurement and construction activities.

CODES AND STANDARDS. The substation facilities shall meet NESC, State, County, and local codes and ordinances as well as IEEE, ASCE, and other applicable industry standards.

ELECTRICAL CONFIGURATION. Unless otherwise stated in the Transmission Interconnection Agreement, all bus designs associated with a connection to KUA's transmission system shall be based on a ring bus or breaker-and-a-half configuration. Radial bus configurations will only be considered for connections to radial loads.

ELECTRICAL RATINGS. The minimum electrical ratings to be used for bus design and equipment selection are identified below. If the Interconnection Planning Study determines that higher ratings are required than those listed, the higher of the two ratings shall be used.

Rating Description	69 kV Facilities	230 kV Facilities
Maximum Voltage	72.5 kV	242 kV
BIL	350 kV	900 kV
Continuous Current	2,000 A	2,000 A
Short Circuit Current	40 kA	40 kA

Ratings shall be based on the following ambient conditions:

Summer	40C
Winter	10C

SUBSTATION STRUCTURES. Structures shall be designed to accommodate the required equipment, bus loadings and wind conditions as defined in the NESC (IEEE C2, latest revision) and in IEEE 605, latest revision. Each structure column shall have provisions for grounding connections.

GROUNDING DESIGN. The grounding system shall be designed in accordance with IEEE 80, latest revision. The system shall be based on the maximum future line to ground short circuit currents indicated above with a maximum clearing time of 0.3 seconds or the duration of local breaker failure clearing time whichever is longer.

SUBSTATION EQUIPMENT RATINGS. Substation equipment shall be furnished in accordance with the latest applicable industry standards. Nameplate ratings shall meet or exceed the electrical ratings identified above. Nameplate ratings shall be considered as both normal and emergency ratings and shall not be exceeded under any condition. Substation equipment is defined as all equipment within the substation directly connected to the substation transmission buses/lines. This includes, but is not limited to, the following devices (when applicable):

- Circuit Breakers
- Disconnect Switches
- Instrument Transformers (PTs, CCVTs, Free Standing CTs)
- Metering Units
- Line Traps
- Transformers
- Shunt or Series Compensation Devices (Reactors, Capacitors)

LIGHTNING AND SURGE PROTECTION. The substation facilities shall have both direct stroke and traveling wave surge protection. Direct stroke protection shall be provided by lightning masts, shield wires, or a combination of both. Direct stroke protection shall be based on the rolling sphere methodology. Surge protection shall be provided by MOV type surge arresters. Ratings shall be determined by the Interconnection Planning Study. As a minimum, surge arresters shall be located at each transmission line termination and adjacent to the high side and low side bushings of all transformers.

BUS DESIGN. Bus design shall be in accordance with IEEE 605, latest revision. Bus conductors shall meet the electrical ratings given above and shall be based on the following condition:

Bus Conductor Temperature	
Normal Rating	70C
Emergency Rating	80C
Wind Speed	2 fps
Emissivity	0.5

PROTECTIVE RELAYING. As a minimum, protective relay schemes shall be in accordance with the requirements indicated below. Each protection system shall have a primary and secondary scheme. The primary and secondary schemes shall be redundant and independent. The design shall allow one scheme to taken out of service for repair, testing, or maintenance without affecting the other scheme and without requiring a facility or equipment outage. Primary and secondary schemes shall be fed from separate dc circuits and operate separate circuit breaker trip coils. All relays shall be microprocessor based and the actual schemes and relay types to be used shall be approved by KUA and identified in the Transmission Interconnection Agreement. Relay settings shall be in accordance with applicable NERC and FRCC reliability, security and loadability requirements. Relay settings shall not limit the normal or emergency ratings of the equipment, conductor or facility within the appropriate zone of protection. The protection schemes shall operate off a 125 volt dc battery installation with a minimum 8 hour rating upon loss of charger supply. General comments for the various systems are as follows:

230 kV Transmission Line Protection. Both the primary and secondary schemes shall be piloted over fiber optic communication circuits. The primary scheme shall be current differential (SEL Type 311L) and the secondary scheme shall be step distance with POTT (SEL 421).

69 kV Transmission Line Protection. The primary scheme shall be current differential (SEL Type 311L) over fiber optic communication and the secondary scheme shall be step distance (SEL 311C).

Bus Protection. Bus Protection shall have primary and secondary bus differential schemes (SEL 587Z).

Autotransformer Protection. Primary (SEO 387) and secondary (SEL 487E) transformer differential schemes, primary and secondary sudden pressure relays.

Circuit Breaker Protection. Local breaker failure, SF6 gas density relays, reclosing, and sync check relays (SEL 351S).

SCADA REQUIREMENTS. An RTU (KUA furnished) shall be installed at the substation to provide indication, control, and metering information back to KUA's dispatch center. A SCADA points list shall be developed during the design process for this RTU. As a minimum, the following control, indication, and analog data will be required (when applicable):

Circuit breaker control (Trip/Close, Recloser On/Off) and indication
Line and Transformer Disconnect Switch Indication
Breaker, Transformer, Station, and Relay Failure Alarms
LTC control (Raise/Lower, Auto/Manual) and indication
Transmission Analog Values (Amps, Volts, MW, MVAR)
Bus Voltage and Frequency
Autotransformer Analog Values (Amps, Volts, MW, MVAR)
Revenue Metering Analog Values (MW, MVAR, MWhrs, MVARhrs)

REVENUE METERING REQUIREMENTS. The revenue metering point(s) will be identified in the Transmission Interconnection Agreement. Revenue metering shall be 3 element and shall utilize metering accuracy (0.3% or higher) instrument transformers. Both primary and secondary meters shall be installed. The exact type and style of meter shall be determined by KUA.

Revision Tracking

No.	Date	Description
0	12/21/05	Initial Issue
1	05/11/07	Added Relay Setting Requirements
2	10/01/10	General Revisions