EAST KENTUCKY POWER COOPERATIVE

Requirements for Facilities Connecting to the EKPC Transmission System

Approved:	Darrin Adams	Date:	3-19-2010

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1	Added document review and availability information - RLO	3/24/09
2	Added paragraph 2 in section 1, wording on VAR support in section 9, and edited line grounding detail attachements – RLO	3/18/10
3	Revised section 2.1 to include requirements to be consistent with NERC Reliability Standard FAC-002-0 involving coordination of plans for new facilities.	5/3/10

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1.0 Introduction

East Kentucky Power Cooperative (EKPC) has prepared this document, which outlines the minimum requirements for all **Transmission Interconnection** or **End-User facilities** and **Generation facilities** (hereinafter referred to as **Requesters**) connecting to the EKPC Transmission System.

All new connections or modifications to existing connections to the EKPC transmission system, including EKPC self-built facilities, must be in compliance with all applicable EKPC connection requirements. Such connections must also comply with all applicable Planning, Operations, and Critical Infrastructure Protection Reliability Standards of the Federal Regulatory Energy Commission's (FERC) approved Electric Reliability Organization (ERO), which is currently the North American Electric Reliability Corporation (NERC), and with all SERC Reliability Corporation (SERC) Supplements to the NERC Reliability Standards.

This document will be reviewed every twelve months to ensure best practices. Upon request, the most recent document of EKPC's Facility Connection Requirements, will be made available within four business days.

1.1 Background

The present electric utility environment is characterized by deregulation, open access to the transmission network, wholesale and retail competition, etc., This present era of rapid change places additional challenges in the planning and operation of electric systems to maintain reliability, safety, and quality of service.

The purpose of this document is to facilitate meeting the demands of this competitive environment. Each request to connect to and use the EKPC Transmission System will be reviewed to identify the impacts and necessary system improvements on the EKPC system. These reviews ensure that comparable treatment is given to all users, and that reliability, safety, and quality of service are maintained.

1.2 Scope

This document informs entities seeking facility connections to the EKPC Transmission System of the connection requirements. These requirements are not a substitute for specific Interconnection Agreements between EKPC and entities connecting to the EKPC Transmission System.

The scope of this document satisfies the NERC Planning Standards by identifying requirements for connections to the bulk transmission system at voltages generally 100 kV and above. This document also applies to connections to those systems designated as transmission facilities that are rated at lower voltages, which include 69 kV. Requirements applicable for all types of

Interconnection, End-User, and **Generation** facilities are covered. These requirements will be applied in a consistent manner to both EKPC-owned facilities and non-EKPC facilities wishing to interconnect to the EKPC transmission system.

The minimum requirements pertaining to connected facilities are contained herein. Reliability concerns in particular are such that additional facility and operational requirements may need to be imposed on connecting facilities based on their location within the system, facility power level and the associated impacts on EKPC's system performance. The need for additional requirements can only be evaluated once certain details of a proposed facility are made known and system impact studies have been conducted. The requirements for initial facility connection apply equally to any upgrades, additions, enhancements, or changes of any kind to an existing connected facility.

The scope of this document is limited to the technical requirements for connected facility design and operation. **Requesters** requiring transmission service are also referred to the EKPC Open Access Transmission Tariff.

1.3 Objectives

EKPC has prepared this document based on the following objectives:

(a) Maintain system reliability, personnel and equipment safety, and quality of service as load, system modifications, and new facilities are added to the transmission network.
(b) Ensure comparability in the requirements imposed upon the various entities seeking to connect facilities to the transmission network.
(c) Satisfy compliance with NERC Planning Standard FAC-001 and corresponding SERC Supplement(s) pertaining to documentation of facility connection requirements by those entities responsible for system reliability.
(d) Inform those entities that seek facility connections to the EKPC Transmission System of the various requirements for system reliability, reporting requirements, (as specified by the NERC Reliability Standards and SERC supplements), and other applicable standards and documents.
(e) Facilitate uniform and compatible equipment specification, design, engineering, and installation practices to promote safety and quality of service.

2.0 Procedures for Coordinated Studies and Notification of new or modified Facilities to Others (R2.1.1 & R2.1.2)

Contact one of the following EKPC personnel to request a new facility connection or significant change to an existing connected facility. This type of request will require a joint study to determine the implications on surrounding system facilities.

Type of Customer to Be Connected	Type of Service or Activity Required from EKPC	EKPC Contact
Generation Interconnection	Initial Contact To Request a Connection or Study	Manager Transmission Planning
Transmission Interconnection	Joint Transmission Planning Studies	Manager Transmission Planning
Transmission End-User	Initial Contact To Request a Connection or Study	Manager Transmission Planning

Following the initial contact regarding a proposed **Generation**, **Interconnection**, or **End-User** facility connection, when the proposed location and power level are established, a plan of service is prepared and system impact studies are undertaken and coordinated by EKPC. The information needed to develop a plan of service and to conduct the system impact studies is identified in this document and should be provided to EKPC at this point. The system impact studies may, as noted above, identify additional requirements for reliability beyond the minimum requirements covered by this document.

EKPC approval of a proposed facility or facility change is contingent upon a design review of the proposed connected facility. Operation of a connected facility is also subject to continuing compliance with all applicable construction, maintenance, testing, protection, monitoring, and documentation requirements described herein, as well as the applicable NERC Reliability Standards and SERC Supplement(s).

2.1 System Impact Studies

The Generator Owner, Transmission Owner, Distribution Provider, and/or Load-Serving Entity seeking to integrate **Generation Facilities**, **Transmission Facilities**, and/or **End-User Facilities** into the EKPC transmission system shall each coordinate and cooperate on its assessments with the EKPC Transmission Planner/Planning Authority. The assessment shall include:

- Evaluation of the reliability impact of the new facilities and their connections on the interconnected transmission systems.

- Ensurance of compliance with NERC Reliability Standards and applicable SERC and EKPC planning criteria and facility connection requirements.
- Evidence that the parties involved in the assessment have coordinated and cooperated on the assessment of the reliability impacts of the new facilities on the interconnected transmission systems. The results of these studies shall be jointly evaluated and coordinated by all of the entities involved.
- Evidence that the assessment included steady-state, short-circuit, and dynamics studies as necessary to evaluate system performance in accordance with NERC Reliability Standards.
- Documentation of study assumptions, system performance, alternatives considered, and jointly coordinated recommendations.

In order to assess the impact of a proposed facility connection on system reliability, system impact studies need to be conducted. These system impact studies, as a minimum, examine the transmission line and transformer loading, voltage profiles and schedules, and power quality impacts of the proposed facility for a range of expected seasonal loading and power transfer conditions. The effect of the proposed facility on short circuit duties would be examined for all transmission connections. A multi-step approach to the proposed facility may be considered where the impact of each step is assessed separately.

The criteria EKPC used to determine what constitutes acceptable performance in the above system impact studies is readily available from EKPC's FERC Form 715 filing.

The system impact studies will be coordinated with neighboring transmission system owners/operators as appropriate. As a minimum, all interconnected neighbors and other impacted parties will be notified of significant transmission system additions or modifications as soon as practical. In addition, significant additions and modifications will be reflected in the power flow models as submitted by EKPC to SERC. These additions and modifications will also be identified in the regional transmission system assessments as appropriate.

EKPC shall retain its documentation of its evaluation of the reliability impact of the new facilities and their connections on the interconnected transmission systems for three years and shall provide the documentation to SERC and NERC within 30 calendar days of a request.

2.1.1 Power Flow Analyses

Power flow analyses will be conducted to examine the impact of the proposed facility on flows through transmission lines and transformers, and voltage profiles. These analyses may typically determine the

maximum load demand in the case of **End-User** facilities or through flow in the case of an **Interconnection** that can be accommodated with minimal or no upgrades to the transmission system. Contingencies consisting of single or multiple outages of lines and/or transformers are considered in these analyses. Where the analyses indicate that transmission upgrades are necessary, alternative reinforcement plans may be devised and evaluated for their capability to accommodate the proposed facility.

2.1.2 Short Circuit Analyses

Short circuit analyses are conducted to examine the impact of the proposed facility on equipment duties. These analyses are primarily concerned with **Generation** and **Interconnection** facilities. Increased fault duties may require upgrading existing circuit breakers and other equipment.

2.1.3 Additional Analyses

Other analyses may be required as part of system impact studies based on power flow analysis and depending on the nature of the proposed connected facility and its location within the transmission network:

(a) Power quality analyses are undertaken for all **End-User** load that could potentially cause harmonic current or voltage, voltage flicker, and/or telephone interference.
(b) The possibility of adverse subsynchronous torsional interaction is investigated wherever the **End-User's** equipment such as arc-furnaces and/or cycloconverters is to be located in close electrical proximity to existing generation.
(c) Stability studies (transient, small-signal, voltage, etc.) will be performed for Generation, Transmission, and End-User Interconnections whenever deemed necessary by EKPC or a neighboring utility.
(d) Impacts on transfer capabilities for EKPC and neighboring utilities will be assessed for Generation, Transmission, and End-User Interconnections.

The scope of all the above system impact studies will be determined by EKPC based on the type, location, and power level of the proposed facility. Normally, EKPC will perform the system impact studies. The cost of these studies will be chargeable to the **Requester** in accordance with the EKPC Open Access Transmission Tariff. Reports documenting the assumptions, results, and conclusions of the system impact studies are made available to the **Requester**.

EKPC must be notified of new facilities, upgrades, or additions such as an increase in load or generating capability of existing facilities connected to the transmission system within the EKPC Control Area. System impact studies are to be conducted to determine the need for any upgrades of transmission equipment or transmission system additions to accommodate the changes in the connected facility. Notification must be provided to EKPC sufficiently in advance of the proposed new facility or the facility modification to allow adequate time for EKPC to assess impacts and perform any necessary transmission-system modifications that may be deemed necessary to accommodate the new facility/facility modification.

3.0 Voltage Level and MW and MVAR Demand (R2.1.3)

The **Requester** will specify the voltage level at which it intends to interconnect to the EKPC transmission system. Nominal transmission system voltages presently on the EKPC system are: 345kV, 161kV, 138kV, and 69kV. The **Requester** connecting to EKPC's Transmission System, should expect voltage levels which generally under system normal conditions and single transmission element outage conditions range between 92% and 105% of nominal. All Interconnected Facilities are expected to operate in this range at all times. If the **Requester's** supply voltage requirements are more restrictive than the 92% to 105% range, EKPC recommends that the **Requester** consider the addition of voltage regulation equipment in their facility.

Under certain emergency conditions, the EKPC Transmission System may operate for a period of time outside of the 92% to 105% range. The **Requester** is responsible for providing any voltage sensing equipment required to protect their equipment during abnormal voltage operation.

Electrical system design of the interconnected facility (e.g., transformers, tap settings, motors and other loads, generator/exciter, voltage regulator) should not restrict any mode of project operation within the EKPC transmission system's allowable voltage range and regulation.

Transmission interconnected equipment should have the tap ranges and self-regulation necessary to operate within EKPC's transmission system voltage range and regulation. All reactive compensation devices associated with an Interconnected Facility must be coordinated with EKPC during both the design phase and system operations.

The impacts of a new facility connection to the EKPC system with regard to neighboring utilities' voltage and/or reactive compensation devices will be assessed. The Requester will be responsible for the cost of mitigating any adverse impacts on the neighboring system.

For an End-Use Facility, the **Requester** will supply 10-year demand projections (both MW and MVARs). For a Transmission or Generation Interconnection, the **Requester** will provide all necessary information needed for EKPC to conduct a System Impact Study to adequately assess the voltage levels and MW/MVAR flows expected if the Transmission or Generation Interconnection is implemented. This information typically will involve detailed modeling data for the transmission network that will be connected to the EKPC system sufficient for power flow, short-circuit, and other engineering analyses.

The Owner of a generating facility connected to the EKPC transmission system will be required to provide the net demonstrated real and reactive power capability of each generating unit to EKPC as required by SERC. The NERC Reliability Standards MOD-024 and MOD-025 provide additional information regarding the requirements for Generator Owners to be in compliance. All data accumulated from testing in compliance with the NERC and SERC requirements should be provided to EKPC in a timely manner. Other generator parameters must also be provided as required by EKPC.

4.0 Breaker Duty and Surge Protection (R2.1.4)

4.1 Interrupting Device / Breaker Duty

The **Requester** shall provide three-phase circuit interrupting device(s) with appropriate protective relaying systems (as stated in Section 5). The device(s) shall isolate the Facility from the EKPC electrical system for all faults, loss of EKPC supply, or abnormal operating conditions regardless of whether or not the Facility is operating.

This device shall be capable of interrupting the greater of the maximum available fault current at that location available from the Transmission System or from the Facility. EKPC will provide, existing and estimated future, 3 phase fault and single line to ground fault amps short circuit data. Recommended change of an interrupting device due to overrating short circuit capabilities, will be the responsibility of the utility causing the increased fault currents.

The three-phase device shall interrupt all three phases simultaneously and shall have maximum operation time of 2 cycles or less from time of energization of the trip coils(s). EKPC may accept 3 cycle interrupting devices depending on their location within the EKPC system. The tripping control of the circuit-interrupting device shall be powered independently of the Transmission System or Facility AC sources in order to permit operation upon loss of the Transmission System connection or the Facility AC supply. The protective trips to the interrupting device should be arranged into two independent trip circuits including separate relay trips, separate DC control busses and two trip coils.

Generally, automatic reclosing of the Facility's interrupting device is not desired. If the Facility's configuration requires automatic reclosing, EKPC will provide the specific reclosing times for the Facility's interrupting devices.

4.2 Surge Protection (Lightning Arresters)

Lightning arrester allowable separation distance from the equipment being protected is based on Table 4 of IEEE Std. C62.22. Consult the manufacturer's catalog for details concerning arrester protective characteristics, ratings, and application. Location and ratings of lightning arresters will be addressed during the design phase of the project.

5.0 System Protection and Coordination (R2.1.5)

The **Requester** is responsible, under all system operating conditions, for providing adequate protection to their facilities as well as EKPC facilities and maintain the safety of the general public. The **Requester** is also responsible for providing adequate protection to their generating facility under any EKPC transmission system operating condition whether or not their generation is in operation.

EKPC will perform relay coordination and short circuit analysis, along with other studies as related to the system, in the area of the new facility. EKPC will provide functional specifications and relay settings for all protective relays at the **Requester's** facility that have a potential impact on the reliability of the EKPC transmission system. The criteria for these functional specifications and settings will be based on existing EKPC protection practices. EKPC reserves the right to specify the type and manufacturer for these protective relays to ensure compatibility with existing relays. The specific recommendations and requirements for protection will be made by EKPC based on the individual substation location, voltage and configuration.

5.1 Requester Protection

It is the **Requester's** responsibility to assure protection, coordination and equipment adequacy within their facility for conditions including but not limited to:

(a) Single phasing of supply
(b) System faults
(c) Equipment failures
(d) Deviations from nominal voltage or frequency
(e) Lightning and switching surges
(f) Harmonic voltages
(g) Negative sequence voltages
(h) Separation from EKPC supply
(i) Synchronizing generation.

(j) Synchronism checking of manual and automatic reclosing of transmission interconnections.
(k) Islanding

The protection systems should minimize system disturbances, outage area, and equipment outage times.

If at any time it is determined that the use of the above relay systems cannot provide adequate protection to the EKPC system, the **Requester** shall furnish and install upon the request of EKPC, a transfer trip receiver(s) at its facility to receive tripping signals originating from an EKPC location(s). This additional protection would also necessitate the purchase and installation of transfer trip equipment at the EKPC location(s) and a communication channel between the EKPC location(s) and the **Requester's** facility. If these systems are required EKPC will coordinate the protection of these devices.

5.2 Automatic Underfrequency Load Shedding

EKPC may require automatic underfrequency load shedding relaying on connected loads to comply with NERC Reliability Standards PRC-006 through 009 and the applicable SERC Supplement. This document requires SERC control areas to shed at least 30% of their connected load in successive steps during system underfrequency emergencies.

EKPC, as a SERC member, is obligated to have an automatic underfrequency load shedding plan in effect, which meets the SERC Supplement. Connecting parties without an automatic underfrequency load shedding plan meeting SERC Supplement requirements may need to install underfrequency relaying at the request of EKPC. The amount of load to be shed and the frequency setpoints will be coordinated and specified by EKPC as required to meet SERC underfrequency load shedding compliance.

5.3 Parallel Generation Facility

The **Requester** shall provide the following utility-grade relays for protection of the EKPC system. All relays specified for the protection of the EKPC system, including time delay and auxiliary relays, shall be approved by EKPC. Relay operation for any of the listed functions shall initiate immediate separation of the **Requester's** generation from the EKPC Transmission System.

Relay	**Function**
Frequency	To detect under frequency and over frequency operation.
Overvoltage	To detect overvoltage operation.
Undervoltage	To detect undervoltage operation.

Ground Detector	To detect a circuit ground on the EKP system (appoicable to three-phase circuits only).
Directional Overcurrent	To detect the directional flow of current in excess of a desired limit
Transfer Trip Receiver	To provide tripping logic to the generation for isolation of the generation upon opening of the EKPC supply circuits.
Directional Power	To detect under all system conditions, a loss of EKPC primary source. The relay shall be sensitive enough to detect transformer magnetizing current suppled by the generation.

The purpose of these relays is to detect the **Requester's** energization of an EKPC circuit that has been disconnected from the EKPC system, to detect the generation operating at an abnormal voltage or frequency, or to detect a fault or abnormal condition on the EKPC system for which the **Requester** shall separate their generation.

Output contacts of these relays shall directly energize the trip coil(s) of the generator breaker or an intermediate auxiliary tripping relay, which directly energizes the breaker trip coil(s). The relaying system shall have a source of power independent from the AC system or immune to AC system loss or disturbances to assure proper operation of the protection scheme. Loss of this source shall cause removal of the generation from the EKPC system. The protective relays required by EKPC and any auxiliary tripping relay associated with those relays shall be utility-grade devices.

Utility grade relays are defined as follows:

(a) Meet ANSI/IEEE Standard C37.90, "Relays and Relay Systems Associated with Electric Power Apparatus."
(b) Have relay test facilities to allow testing without unwiring or disassembling the relay.
(c) Have appropriate test plugs/switches for testing the operation of the relay.
(d) Have targets to indicate relay operation.

It is the **Requester's** responsibility to determine that their internal protective equipment coordinates with the required EKPC protective equipment and is adequate to meet all applicable standards to which the generation is subject. EKPC further reserves the right to modify relay settings when deemed necessary to avoid safety hazards to utility personnel or the public and to prevent any disturbance, impairment, or interference with EKPC' ability to serve other customers.

The following items should be coordinated with each other.

- Volts/Hz and overexcitation protection/limiting.
- Loss-of-excitation and underexcitation limiting.

5.4 Power System Stabilizer

A Power System Stabilizer (PSS) is required to be installed, tuned, and activated with the excitation system for all new synchronous generators connected to the EKPC transmission system.

For generators already connected to the EKPC system that do not presently have a PSS, a PSS must be retrofitted when the excitation system or voltage regulator is replaced. These retrofitted stabilizers must be tuned and activated unless EKPC determines this is not necessary. If EKPC identifies a need for a PSS for an existing generating unit, the generator owner may be required to procure, install, tune, and activate a PSS.

The PSS is expected to be an accelerating power delta-P-omega type. Other types that are functionally equivalent may be accepted on a case-by-case basis.

The generation owner will be responsible for the analysis, procurement, installation, tuning, and testing of the exciter and stabilizer controls for optimum performance. The generator owner must ensure that all necessary studies and field tests are performed to determine the optimum PSS settings prior to commercial operation of the generating unit. EKPC shall perform (or contract to have performed on its behalf) other relevant studies, and shall coordinate with the generator owner and the equipment vendor to establish reliable settings for the PSS. The PSS tuning test documentation – including the PSS dynamic model and final settings – shall be provided to EKPC for its review prior to the commencement of commercial operations for new generating units. For existing generating units that are retrofitted with a PSS, the documentation shall be provided when the testing of the PSS is complete.

If future system conditions change significantly, EKPC may require the generator owner to reset the PSS parameters to more appropriate settings to preserve the overall reliability of the transmission system.

A PSS may be taken out of service for scheduled maintenance only with EKPC's prior approval. The generator owner will be required to take the PSS out of service if EKPC identifies transmission system operating conditions during which the operation of the PSS would adversely affect the stability of the transmission system or its connected generators. If a PSS is removed from service or is not capable of automatic operation, the generator owner shall immediately notify EKPC. Operating limits may be applied in such cases based on system limitations identified by EKPC.

If system studies or field experience do not show need for a PSS, EKPC may waive these requirements for generators rated at 50 MVA or less, or for generators connected at 69 kV or below. These requirements will not be waived for any generating units at a single generating station with total rated output greater than 300 MVA.

5.5 Remote Relay Access

All new facilities, or upgrades to existing facilities, should use digital relays with fault recording capabilities. All digital relays, used for protection of EKPC transmission facilities, shall have the capability of recording system disturbance information and EKPC shall be allowed access to all relay records.

5.6 Relay and Equipment Data

At least three (3) months prior to the in-service date, the following data shall be received by EKPC. If the data is not available three months prior to the in-service date, the **Requester** shall provide estimates based on their design information. Such data shall be identified as "estimated" and replaced with actual data by the **Requester** as it becomes available prior to installation.

The purpose of the data to be provided to EKPC by the **Requester** is to ensure proper coordination to protect against equipment or facility damage, to mitigate safety hazards to utility personnel and the public, and to minimize disturbances, impairment, or interference with EKPC's ability to serve other transmission system users.

5.6.1 Data on Equipment to be installed

(a) Interrupting Devices and Relays - Complete manufacturer's data for interrupting devices and relays or fuses used for the protection of the EKPC system and/or the generation.
(b) Power Transformers - Complete nameplate or test sheet data, including manufacturer, serial number, high- and low-side voltage taps, kVA ratings, impedance, load loss and no load loss watts, high- and low-side voltage winding connections, low-side voltage winding grounding (if used), and high voltage inrush current.
(c) Power Capacitors – Location, KV, and KVAR rating of capacitor banks, number of units, and bank configuration.

5.6.2 Additional Data on the Generation Protection Equipment

(a) Including make-before-break transfer switches, fuses, breakers, relays, relay settings associated with the proposed generation.

(b) Complete manufacturer's data and specifications for make-before-break transfer switches, including transfer times and conditions of transfer, testing procedures, equipment schematics, and backup protection.

5.6.3 Final Generator Data

(a) Type (synchronous, induction, DC with solid-state inverter, etc.)
(b) Nameplate data and ratings, including any rectifying, regulating, or inverting equipment.
(c) Harmonic content at full rated output
(d) Detailed Dynamic Performance Data in accordance with Appendix A.
(e) Real and Reactive capabilities at scheduled voltages.

6.0 Revenue Metering and Telemetry Requirements (R2.1.6)

6.1 Revenue Metering

EKPC approved revenue class metering equipment shall be installed at the delivery point to meter the aggregated load of the connected facility consisting of instantaneous bi-directional real and reactive power and integrated hourly real and reactive energy metering.

The metering equipment will include potential and current transformers, meters and test switches. The accuracy of the instrument transformers will be 0.3 percent or better. The secondary wiring and burdens of the instrument transformers will be configured so that they do not degrade the total accuracy by more than 0.3 percent. The metering equipment should meet or exceed accuracy class 0.2 and will be tested periodically as defined in the service agreement and the test results will be available to all involved parties. The meters, test switches and wiring termination equipment will be sealed and the seal may be broken only when the meters are to be tested, adjusted or repaired. Proper authorities from both parties will be notified when seals are broken.

Three metering elements will be used to measure all real and reactive power crossing the metering point. Bi-directional energy flows including watt-hour and var-hour will be separately measured on an hourly basis. Appropriate demand quantities will be metered in terms of kilowatts, kilovars or kilovolt-amperes. If required, voltage measurements will be provided.

The instrument transformers used for revenue metering shall be installed on the high voltage side of the **Requester's** step-down transformer. Under special circumstances but only with written approval granted by EKPC, revenue metering may be performed on the low voltage side of the step-down transformer. Written approval shall only be given if the **Requester** can demonstrate that accurate transformer loss compensation will be programmed into the revenue metering

when instrument transformers are installed on the low voltage side of the step-down transformer.

6.2 Telemetry

Suitable telemetry equipment will be installed at the metering point to provide real-time telemetry data to EKPC and to all other participating parties.

Telemetry equipment will include transducers, remote terminal units, modems, telecommunication lines, and any other equipment of the same or better function. The remote terminal unit, or equivalent device, must have multiple communication ports to allow simultaneous communications with all participating parties. That device will accommodate data communication requirements specified by each participating parties control center, including communication protocol, rate and mode (either synchronous or asynchronous). All metered values provided to the telemetry equipment will originate from common metering equipment. All transducers used for telemetry will have at least 0.2 percent accuracy. As part of real-time data to be provided, EKPC has the right to require the status and remote control of switching devices at the Receipt and/or Delivery Points.

A continuous, accumulating record of megawatt-hours and megavar-hours will be provided by means of the registers on the meter. Freezing accumulation data for transmission will be taken every clock hour. The freezing signals must be provided by only one agreed-upon party. If the freeze signal is not received within a predefined time window, the remote terminal unit, or equivalent device, will be capable of freezing data with its own internal clock.

The metering, if external power supply is required, and telemetry equipment will be powered from a reliable power source, such as a station control battery, in order to allow the equipment to be continuously operational under any abnormal power supply situations. Proper surge protection will be provided for each communication link to protect communication hardware from ground-potential-rise due to any fault conditions. A separate communication media shall be provided to allow EKPC to remotely retrieve billing quantities from the meters. When real-time telemetry is required, a back-up data link must be provided in case of the outage of the primary telemetry line. The back-up link can be a data communication link between involved control centers; the party requesting service is responsible for furnishing the back-up link.

At the discretion of EKPC, generation control facilities and supervisory control and data acquisition of specific electrical devices from the EKPC Control Center may be necessary to integrate the generation into EKPC's control area. Such additional facilities, including required communication channels, shall, if required, be furnished and installed by the **Requester**. The requirement for data

acquisition and control will depend on the generation capacity, system location and voltage, and the net generation input into EKPC System.

Data acquisition and control information will typically include, but not be limited to:

(a) desired generation MW set point
(b) automatic generation control status (on,off)
(c) generator availability
(d) generation MW, Mvar output
(e) generator minimum and base MW capability
(f) generator MW AGC high limit and low limit
(g) connection facilities' breaker status/control/alarms
(h) connection facilities' MW and Mvar line values and bus voltage
(i) generator and substation metering (MWh) data

7.0 Grounding and Safety (R2.1.7)

7.1 Ground System Resistance

The grounding system should be designed in accordance with IEEE Standard 80 - latest revision, "IEEE Guide for Safety in AC Substation Grounding." In evaluating the step and touch potential the target body weight value should be set to 50 kg. If a reasonable grounding design is unobtainable using the 50 kgs, then consider a body weight of 70 kg as the absolute minimum allowable.

Ground fault levels from EKPC sources will be provided as needed for **Requester's** ground grid analysis. **Requester** equipment ground sources can contribute significant fault current independent of the ground fault values on EKPC's System. These **Requester** ground sources should be considered in the design of the grounding system.

If the facility structure is to be wood-pole type construction, the transmission line overhead ground wire, all switch bases, fuse bases, and other noncurrent-carrying metal parts shall be grounded to the station grid. See Appendix C for grounding installations.

7.2 Electrical Safety Clearances (Outdoor)

Electric facility design clearances are listed in the table in Appendix B. These design clearances should be used for electrical facilities up to and including any interrupting device connected directly to an EKPC transmission line and for all facilities that are part of the EKPC transmission system.

The minimum vertical clearance of the conductors above ground and the vertical and horizontal clearance of conductors passing by but not attached to a building or wall shall be in accordance with the NESC or applicable state and local codes.

7.3 Facility Fence Safety Clearances

The fence safety clearances in the **Requester's** facility shall comply with Section 11 of ANSI C2-1997, "National Electrical Safety Code."

8.0 Insulation and Insulation Coordination (R2.1.8)

8.1 Insulators for Station

Required station post insulator types are listed in Appendix B. Facilities in areas with significant airborne pollution may require a higher insulation level. Higher strength insulators are available and should be used if needed to meet bus momentary short circuit withstand values. Other requirements may be necessary due to atmospheric, geological, seismic, or environmental conditions and will be discussed during the design phase of the project.

8.2 Equipment Basic Insulation Levels

The minimum Basic Insulation Levels (BIL) for Equipment are listed in Appendix B. Facilities in areas with significant airborne pollution may require a higher insulation level.

9.0 Voltage, Reactive Power, and Power Factor (R2.1.9)

The NERC Reliability Standards state that distribution entities and customers connected directly to the transmission systems should plan and design their systems to operate at close to unity power factor to minimize the reactive power burden on the transmission systems. The EKPC interpretation of "close to unity power factor" is that the power factor of the connected load should be within the range of 0.95 lagging to 0.98 leading.

Unless otherwise restricted by Retail Tariffs, the maximum hourly reactive power (kVAr) demand, both leading and lagging, will be identified each month at the delivery point(s). An **End-User** will incur no charges for power factor if the maximum lagging kVAr demands do not exceed 33% of the real power (kW) demand or maximum leading kVAr demands do not exceed 20% of the real power (kW) demand in the same time interval. If the maximum hourly leading and/or lagging kVAr demands exceed these values, charges will be assessed. The charges will be based on the applicable state or FERC filed tariff.

Capacitors generally provide an effective means of controlling the power factor of a **Requester's** facility. However, there are several factors that should be

addressed in applying capacitors. These factors can include, but are not limited to, transient voltages due to capacitor switching and voltage amplification due to resonance conditions. The services of a qualified consultant should be obtained to review the specific application and provide recommendations in regard to control of these phenomena.

For **Transmission Interconnections**, EKPC will evaluate whether the connection to the EKPC system creates a significant reactive burden. Potential reactive flows across the new Transmission Interconnection will be assessed for a wide range of conditions. Voltages in the vicinity of the Transmission Interconnection will also be assessed to identify potential degradation on the EKPC system. The **Requester** will be responsible for addressing any voltage or reactive flow issues that are created as a result of a proposed **Transmission Interconnection**.

All facilities interconnected to the EKPC transmission system should have the tap ranges and self-regulation necessary to accommodate the transmission system's reactive power flow requirements.

9.1 Generation Power Factor Requirements

The Interconnection Customer shall design its Generating Facility to maintain a composite power delivery at continuous rated power output at the Point of Interconnection at a power factor within the range of 0.95 leading to 0.95 lagging.

If an engineering study demonstrates that the Generating Facility cannot meet the reactive supply requirements, the Generating Facility must install power factor correction devices to support the VAR requirements in the local area.

9.2 Generation Voltage Schedules

All generators must contribute reactive power to the transmission system in order to maintain the reliability of the transmission system. NERC Planning Standards require that Generator Owners and Transmission Providers work jointly to optimize the use of reactive power capability. Therefore, all generators interconnected with the EKPC transmission system are required to maintain a prescribed voltage schedule in order to support VAR requirements in the local area.

The generation facility must be capable of continuous non-interrupted operation at a specified voltage setpoint that is within a steady-state voltage range during both system normal and single-contingency conditions. This range is from 91.7% to 105.8%. During emergency and/or transient-system conditions, when voltage may temporarily be outside of this range, all reasonable measures should be taken to avoid tripping the generator due to high or low voltage. Internal plant

design (e.g., transformer ratings/taps/impedance, cooling systems, generator/exciter ratings) should not limit continuous reactive capability.

EKPC's transmission system is designed to operate between 90% and 105% of nominal voltage during normal and single-contingency conditions. If the requirements of the Facility Owner's equipment is more restrictive than these limits, the installation of voltage regulation devices by the Facility Owner should be considered.

Specification of the generator voltage schedule will be provided to the interconnected generating facility by EKPC's System Operator. EKPC will exercise reasonable efforts to provide the Interconnection Customer with such schedules at least one (1) day in advance, and may make changes to such schedules as necessary to maintain the reliability of the transmission system. A steady-state deviation from this schedule between +2.5% and –2.5% of the voltage setpoint will be permissible.

Once the Interconnection Customer has synchronized the generating facility with the transmission system, EKPC will require the Interconnection Customer to operate the generating facility to produce or absorb reactive power within the design limitations set forth above. EKPC's voltage schedules will treat all sources of reactive power in the Control Area in an equitable and not unduly discriminatory manner. The Interconnection Customer shall operate the generating facility to maintain the specified output voltage (or power factor,if appropriate) at the Point of Interconnection within the design limitations of the generating facility set forth above. This may require operation of the interconnected Generating Facility to its maximum reactive capability when necessary to maintain the specified voltage schedule. If the Interconnection Customer is unable to maintain the specified voltage (or power factor), it shall promptly notify EKPC's System Operators.

For generators with output at or above 20 MW, the generator must have an Automatic Voltage Regulator (AVR) capable of maintaining the generator output voltage within limits (generally +/- 5%) for generator loading from no-load up to rated output.

All synchronous generators connected to the EKPC transmission system shall be equipped with speed governing capability. This governing capability shall be unhindered in its operation.

Whenever the generating facility is operated in parallel with the transmission system, and the speed governors (if installed on the generating unit pursuant to Good Utility Practice) and voltage regulators are capable of operation, the Interconnection Customer shall operate the generating facility with its speed governors and voltage regulators in automatic operation. If the generating facility's speed governors and voltage regulators are not capable of such

automatic operation, the Interconnection Customer shall immediately notify EKPC's System Operator, or its designated representative, and ensure that such generating facility's reactive power production or absorption (measured in MVARs) are within the design capability of the generating facility's generating unit(s) and steady state stability limits.

EKPC typically specifies voltage regulation at the terminals of an interconnected generator. However, voltage regulator load compensation may be required to control voltage at a point beyond the generator terminals for a new generator interconnected to the EKPC transmission system. All appropriate excitation system settings of an Interconnected Generator must be coordinated with EKPC.

The Interconnection Customer shall not cause its generating facility to disconnect automatically or instantaneously from the transmission system or trip any generating unit comprising the generating facility for an under-frequency or over-frequency condition unless the abnormal frequency condition persists for a time period beyond the limits set forth in ANSI/IEEE Standard C37.106, or such other standard as applied to other generators in the EKPC Control Area on a comparable basis.

The Customer shall provide a current-limiting device for the generating unit's excitation system that will act in conjunction with, or supersede, the AVR to automatically reduce excitation so that generator field current is maintained at the allowable limit in the event of sustained undervoltages on the transmission system. This device must not prevent the exciter from going to and remaining at the positive ceiling following the inception of a fault on the power system. The amount of time that the exciter is allowed to remain at the positive ceiling shall be provided to EKPC upon request.

The Customer shall equip the generating unit with a limiter to prevent instability resulting from generator underexcitation.

EKPC studies may identify the need for the use of Power System Stabilizers (PSS) depending on the generating facility output capability, excitation system type and settings, facility location, area transmission configuration, or other factors. This will be determined on a case-by-case basis.

The Customer shall coordinate the Generator Step-Up (GSU) and auxiliary transformer impedances and tap specifications with EKPC. EKPC may require the Customer to change these values either prior to connection or after the generating facility has become operational to meet voltage schedule and/or reactive support requirements, as warranted by transmission system analyses.

The Customer shall ensure that the full range of generator reactive power capability is available for applicable normal and emergency network voltage ranges.

The requirements for generators contained in this Section 9 applies to all generating facilities with a total gross rated output in excess of 20 MW. EKPC may require generating facilities below this threshold to provide reactive support capability on a case-by-case basis.

10.0 Power Quality Impacts (R2.1.10)

Power quality studies will be performed, as deemed necessary by EKPC, to define acceptable operating ranges and limits. Studies may include, but not be limited to the following design parameters:

- Harmonic Distortion
- Voltage Fluctuation
- Voltage Flicker
- Sensitive Electrical Equipment
- Transformer Protective Devices
- Unbalanced Electrical Conditions
- Subsynchronous Torsional Interaction
- Transient Overvoltage
- Temporary Overvoltage
- Temporary Undervoltage
- Operating Frequency
- Interruption/Outage Frequency

Studies may identify additional equipment necessary to meet power quality standards.

Connection of a generator, transmission facility, or end-user load to EKPC transmission system should not unacceptably compromise or degrade the power quality for existing EKPC customers.

Installation of power quality monitoring equipment by EKPC may be required to verify compliance with EKPC's power quality performance requirements.

10.1 Harmonic Distortion, Voltage Fluctuations and Voltage Flicker

Certain electrical equipment located at the **Requester's** facility (arc furnaces, cycloconverters, etc.) will generate voltage flicker and harmonic distortion, which can negatively impact the EKPC system. Should this be the case, the **Requester** shall take responsibility, initially or in the future, for limiting interfering levels of harmonic voltage, current distortion, and/or voltage flicker. Limits for harmonic distortion (including inductive telephone influence factors) are as published in the latest issues of ANSI/IEEE 519, "Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems." EKPC may, initially or in the future, require the installation of a monitoring system to permit ongoing

assessment of compliance with these criteria. The monitoring system, if required, will be installed at the **Requester's** expense.

Situations where high harmonic voltages and/or currents originate from the transmission system are to be addressed in the Connection Agreement.

EKPC will evaluate requests for **Transmission Interconnection** to identify potential unacceptable voltage flicker and/or harmonic distortion that would be created by the **Transmission Interconnection**. The Requester will be responsible for any mitigation that is required.

Voltage flicker limits are as specified in IEEE Standard 141-1993. Voltage fluctuation limits are as specified in the applicable IEC-61000 set of standards. Steady-state voltages should remain within the voltage limits prescribed in Section 3.0.

10.2 Sensitive Electrical Equipment

Certain electrical equipment in the **Requester's** facility may be sensitive to normally occurring electric interference from nearby connected loads in the **Requester's** facility, from other **End-Users** connected to the power system, from natural causes, and system switching, etc. If sensitive electrical equipment is to be supplied directly from the electric power system, **Requester** or **Requester's** consultant should examine the equipment grounding requirements and power supply requirements prior to installation. Attention should be given to equipment tolerance to various forms of electric interference, including voltage sags and surges, momentary outages, transients, current and voltage harmonic distortion, or other electrical and electromechanical noise. When electrical disturbances to sensitive electrical equipment such as computers, electronics, controls, and communication equipment cannot be tolerated, the **End-User** shall install additional equipment as may be necessary to prevent equipment malfunctions and protect against equipment failure. The **End-User** should consult the supplier of such sensitive electrical equipment regarding the power supply requirements or the remedial measures to be taken to alleviate potential misoperation or failure of the equipment. The **End-User** may need to hire a power quality consultant to also perform a site survey of the electric power supply environment and furnish recommendations to provide the acceptable levels of reliability and quality of service.

10.3 Transformer Protective Devices

EKPC has typically installed circuit switchers or circuit breakers on the high side of transmission/step-down transformers.

The use of a remote tripping (transfer trip) system to initiate tripping of a remote breaker(s) to isolate an End-User's transformer will not be considered as the

primary protection scheme, but may be considered as a back up system to the circuit switcher or breaker. Transfer trip systems must include a local isolating motor operated air break switch to permit remote terminal circuit breakers to reclose and return the transmission line to service. Remote tripping systems will only be considered where continuity of service of the line is not critical.

A grounding switch installation designed to place faults on the system and isolate a fault in the transmission/step-down transformer is not to be applied to the EKPC system. Ground switches cause objectionable voltage sags and momentary interruptions to the other EKPC End-Users and unnecessary stresses to the power system.

10.4 Unbalanced Electrical Conditions

Situations where high unbalance, in voltage and/or current, originate from the transmission system are to be addressed in the Connection Agreement.

10.4.1 Voltage Balance

Voltage unbalance attributable to the **End-User** facilities shall not exceed 1.0% measured at the point-of-service. Voltage unbalance is defined as the maximum phase deviation from average as specified in ANSI C84.1, "American National Standard for Electric Power Systems and Equipment – Voltage Ratings, 60 Hertz."

10.4.2 Current Balance

Phase current unbalance attributable to the **End-User** facility shall not exceed that which would exist with balanced equipment in service, measured at the point-of-common coupling. In no event should current unbalance exceed 5% measured at the point of delivery.

10.5 Subsynchronous Torsional Interaction

Certain **End-User** equipment, in particular electric arc furnaces and cycloconverters, may cause adverse interactions and possible damage to existing turbine-generators located in close electrical proximity. These situations will be analyzed by EKPC, or EKPC's consultant, and appropriate corrective or preventive measures identified as needed. Corrective and preventive measures may consist of torsional current monitoring at a defined point of compliance, special protective relaying on the turbine-generator shaft(s), or constrained operation of the **End-User** equipment under certain system configurations. Costs of studies and the design and installation of protective and/or monitoring equipment shall be the responsibility of the **Requester**.

10.6 Transient and Temporary Overvoltages

The design of facilities connected to the EKPC transmission system must address the mitigation of transient and temporary overvoltages that may be caused by lightning strikes, faults, breaker switching, etc. A facility connected to the EKPC transmission system shall not cause a peak transient voltage at the Interconnection Point that is 140% or more of the nominal system voltage. Furthermore, a facility connected to the EKPC transmission system shall not cause a peak temporary (lasting greater than 20 milliseconds) voltage at the Interconnection Point that is 120% or more of the nominal system voltage.

10.7 Temporary Undervoltages

A facility connected to the EKPC transmission system should not result in more than two occurrences in a 12-month period of a voltage level at the Interconnection Point that remains at 85% or less of the nominal system voltage for more than 20 milliseconds. During non-fault conditions, the voltage at the Interconnection Point should be at least 92% at all times.

10.8 Operating Frequency

The nominal operating frequency of the EKPC transmission system is 60 Hz. Operation of any Facility connected to the EKPC system shall be designed for this frequency. The Facility should not contribute to any variation from this frequency. As discussed in section 5.2, an End-User Facility may be required to participate in EKPC's automatic load-shedding program. EKPC will also assess the impacts of Generation and Transmission facilities on system frequency to ensure that adequate protection exists to prevent significant frequency excursions from nominal system frequency.

10.9 Interruption/Outage Frequency

EKPC operates and maintains its system to provide reliable and safe service at all times. Connection of a Facility to the EKPC system requires that connected equipment not restrict timely outage coordination, automatic switching, or equipment maintenance scheduling. If a Facility is determined to present a potential risk to the reliability of the EKPC transmission system, additional switchgear, equipment redundancy, or bypass capabilities at the Interconnected Facility may be required.

The Interconnected Facility shall not cause an unplanned interruption/outage of another facility on the EKPC system more than once in any twelve-month period.

11.0 Equipment Ratings (R2.1.11)

For tap and looped connections, the **Requester's** high voltage bus and associated equipment, such as breakers, switches, connectors, and other

conductors shall have continuous, long-term emergency, short-term emergency, and momentary asymmetrical current ratings which: (1) do not limit the EKPC transmission system network capability and (2) have adequate capability for the initial and future system conditions identified by EKPC. All substations connected to the EKPC system shall meet the requirements of EKPC's substation design and construction standards, and must be designed to the applicable requirements of NESC, ANSI, and IEEE Standards. All interrupting devices, such as circuit breakers shall have interrupting capability sufficient to satisfactorily interrupt the maximum short-circuit currents that may occur at the location of the interconnection, including margin for circuit-breaker duty and DC offset. Where the substation becomes a facility within the intercepted path, EKPC shall design, construct, own, and maintain the facility at the Customer's expense.

For transmission lines interconnecting into EKPC's facilities, transmission line ratings shall meet the requirements of EKPC's transmission line design standards, including MVA, operating voltage, ampacity, insulation critical flashover, insulation clearances, shielding, tower grounding, and short circuit withstand requirements. In all cases the National Electric Safety Code (NESC) and OSHA requirements shall be satisfied. The Requester shall make available to EKPC all drawings and specifications, termination plans, and equipment ratings.

The effects resulting from wind storms, floods, lightning, altitude, temperature extremes, and/or earthquakes shall be considered in the design and operation of a facility connected to the EKPC system. Depending on the location, size, type, etc., of the facility, EKPC may impose additional requirements to be met by the owner/operator.

EKPC, as a borrower from the Rural Utilities Service (RUS), must comply with all RUS regulations, including following the NEPA environmental clearance processes. Any Project involving connection the the EKPC transmission system must follow these regulations.

Any equipment changes on the EKPC transmission system necessitated by connection of a new facility to the EKPC system will be performed by EKPC at the expense of the owner of the new facility requesting interconnection to the EKPC system. The proposed facility may not be allowed to connect to the EKPC system, or the facility's operations may be restricted, until any EKPC system limitations have been addressed.

12.0 Synchronizing Systems (R2.1.12)

All **Requester's** facilities, which include include transmission interconnections, End Users with backup generation and all Generation Owners, capable of independent voltage support or power supply, shall have equipment to measure

or check for synchronism of the facility with the EKPC system. Connection or reclosing of the facility shall not be allowed for out-of-sync conditions to protect the EKPC and **Requester's** systems from damage or loss of stability. Remote synchronizing to the EKPC system will be acceptable provided the Requester have adequate synch check equipment installed, and approved by EKPC, at their facility.

The **Requester** shall assume all responsibility for properly synchronizing their generation for operation with the EKPC Transmission System. Upon loss of the EKPC supply, the **Requester** shall immediately and positively cause the generation to be separated from the EKPC system. Synchronizing of generation to the EKPC Transmission System may be, at EKPC's discretion, performed under the direction of the EKPC Control Center.

13.0 Maintenance Coordination and Scheduled Outages (R2.1.13)

The Requester is to consult and coordinate with an EKPC Operations Engineer on all requests for outages to a Requester's facility that affects the EKPC Transmission System. Outage requests should be made according to the schedule outlined in EKPC's Outage Submission and Coordination document. After approval of the Requester's outage request by the Operations Engineer and, if applicable, the TVA Reliability Coordinator (RC), the Transmission Operator will follow EKPC's Lock Out and Tag Out Procedure to provide switching instructions to field personnel, issue Hold Cards and/or Caution Orders, and to issue safety working clearances to field personnel.

All **Requester** owned equipment up to and including the first protective fault interrupting device is to be maintained to EKPC standards. This may include substation equipment such as circuit breakers, circuit switchers, power fuses, instrument transformers, switches, surge arresters, bushings, relays, and associated equipment (including DC systems, grounding systems, etc.). Any **Requester** owned transmission line and its associated parts – up to the first fault interrupting device must also be maintained to EKPC standards. Detailed maintenance procedures shall be provided on request. EKPC is required to follow NERC Standard PRC-005 to maintain all equipment necessary to protect the system.

The **Requester** shall have an organization, approved by EKPC, test and maintain all devices and control schemes provided by the **Requester** for the protection of the EKPC system. Included in the testing and maintenance will be any initial set up, calibration, and check out of the required protective devices, periodic routine testing and maintenance, and any testing and maintenance necessary for an upgrade or changeout of the protective devices initiated by a **Requester** or EKPC.

If the **Requester's** testing and maintenance program is not performed in accordance with EKPC's maintenance requirements, EKPC reserves the rights to inspect, test, or maintain the protective devices required for the protection of the EKPC System.

All costs associated with the testing and maintenance of devices provided by the **Requester** for the protection of the EKPC system, including costs incurred by EKPC in performing any necessary tests or inspections, shall be the responsibility of the **Requester**.

EKPC reserves the right to approve the testing and maintenance practices of a **Requester** when the **End-User's** system is operated as a network with the EKPC transmission system.

The owner/operator of a facility connected to the EKPC transmission system is responsible for the regularly scheduled calibration and/or maintenance of its equipment, including, but not limited to generators, circuit breakers, power transformers, protective relays, revenue metering, communications devices, trip circuits, interrupters, DC power sources, grounding systems, and transmission facilities. Maintenance practices should be consistent with Good Utility Practice, and should be performed at a level that ensures the reliability and continuity of service of the interconnected transmission system. All relevant maintenance records should be maintained and provided to EKPC within 15 business days of a request.

14.0 Operational Issues (R2.1.14)

Operational issues on EKPC's system, either during normal or emergency conditions, may affect EKPC's control performance. Under certain conditions the **Requester** may have to install disturbance monitoring and/or control equipment as appropriate and detailed in section 5.

15.0 Inspection Requirements (R2.1.15)

The **Requester** is responsible for installing appropriate equipment and facilities to be compatible with the EKPC Transmission System. The **Requester** is also responsible for meeting any applicable federal, state, and local codes.

Before a **Requester** owned facility can be energized, it must pass a final inspection by EKPC personnel. EKPC will inspect all substation equipment from the point of interconnection to the first protective fault interrupting device and the ground system. This may include circuit breakers, circuit switchers, power fuses, instrument transformers, switches, surge arresters, bushings, and relays and associated equipment (including DC and grounding systems). The inspection will consist of a visual inspection of all major equipment as well as review of required

test results. Nameplate information on all equipment will need to be recorded and given to EKPC prior to final inspection.

The ground system must be checked before any overhead ground wires are attached from outside lines, by using the resistance measurement procedures in accordance with IEEE Standard 81 "Recommended Guide for Measuring Ground Resistance and Potential Gradients in the Earth." The EKPC inspection will be documented by completing a site-specific form supplied by EKPC. An example of the form, showing the types of information required is shown in Appendix D.

EKPC should be allowed access, upon notification, to **Requester's** facility for any requirement related to NERC standards, which may need to be reported. Details of access and notification can be determined when agreement is reached.

16.0 Communications (R2.1.16)

For any abnormal system operational issues, emergency telephone numbers agreed on by both parties will be available prior to the actual interconnection date. Under no circumstance shall a **Requester** energize EKPC transmission facilities that have been de-energized without the consent from EKPC Control Center. Circuits that are electrically disconnected from the EKPC transmission system and are energized by a **Requester** constitute a potential safety hazard for both EKPC transmission personnel and the general public. Also, the energizing of such circuits at abnormal voltage or frequency could cause damage to electrical equipment of both the EKPC Transmission System and the generation.

The **Requester** is responsible for operating its generation with full regard for the safe practices of, and with full cooperation under the supervision of the EKPC Control Center.

16.1 Voice Communications

A. Normal – At EKPC's request, the **Requester** shall provide a dedicated voice communication circuit to the EKPC Control Center. Such a dedicated voice communication circuit would originate from the **Requester's** office staffed 24 hours a day and would be typically required for connected transmission facilities that significantly affect the EKPC transmission network capacity and operations.

All other normal voice communication concerning facility operations shall be conducted through the public telephone network to the Control Center phone number(s) issued by EKPC.

B. Emergency – Voice communications in the event of a transmission facility emergency shall use the dedicated voice circuits, if available, or public telephone network and phone number(s) designated for emergency use.

It is the **Requester's** responsibility to take prudent steps when an area or system wide capacity emergency is declared. Load reductions shall be implemented by reducing non-essential loads. This type of reduction is usually conveyed through the local media. If the **Requester** has generating units EKPC's Control Center may give specific instructions regarding the operation of the **Requester's** units, depending on the nature of the emergency.

The **End-User's** EKPC representative is responsible for providing the EKPC Control Center a "customer contact list." This listing contains the **End-User's** EKPC representative and backup person as well as their business, home and pager numbers.

These **End-Users** shall be provided an unlisted phone number to be used for emergency or routine operations. Operational emergencies (equipment) warrant a direct call either way.

16.2 Interruptible Contracts

Owners of transmission facilities that have an EKPC interruptible contract shall install communication facilities with the EKPC Control Center as specified in the contract.

16.3 Emergency Operating Conditions

End-User's facilities may be subject to EKPC's System Restoration Plan that can require interruption of load to deal with generation deficiencies and/or transmission system emergencies. It is noted that interrupting of load will only be done in extreme conditions that would result in a more serious degradation of system performance than if the load were not shed.

17.0 Coordination with Other Codes, Standards, and Agencies

The information contained in this document is supplementary to and does not intentionally conflict with or supersede the National Electric Code (NEC) as approved by the American National Standards Institute (ANSI) or such federal, state and municipal laws, ordinances, rules or regulations as may be in force within the cities, towns or communities in which EKPC furnishes electric service. It is the responsibility of the **Interconnection** or **End-User** to conform to all applicable national, state and local laws, ordinances, rules, regulations, codes, etc.

18.0 Indemnification

The use and reliance upon the information contained in this document shall in no way relieve the **Requester** or **Facility Owner** from the responsibility to meet NEC, NESC, ANSI, etc. requirements governing their design, construction, operation, and materials or from responsibility for the protection and safety of the general public.

The **Requester**, for itself, its successors, assigns and subcontractors agrees to pay, indemnify and save East Kentucky Power Cooperative, its successors and assigns, harmless from and against any and all court cost and litigation expenses, including legal fees, incurred or related to the defense of any action asserted by any person or persons for bodily injuries, death or property damage arising or in any manner growing out of the use and reliance upon the information provided by EKPC. Reliance upon this information shall not relieve the **Interconnection** or **End-User** from responsibility for the protection and safety of the general public.

Parties wishing to connect to the EKPC transmission system shall agree to the following terms to be included in any Interconnection Agreement:

Indemnity by (Entity)

(Entity) agrees to defend, indemnify and hold harmless EKPC, its directors, officers, employees and agents, from any and all damage, loss, claim, demand, suit, liability, penalty, or forfeiture of every kind and nature- including but not limited to attorney fees and other costs and expenses of defending against the same and payment of any settlement or judgment therefore, by reason of a) injuries or deaths to persons, (b) damages to, destruction of or interference with the use of properties, (c) pollutions, contaminations of or other adverse effects on the environment or (d) violations of governmental laws, regulations, or orders-whether suffered directly by EKPC itself or indirectly by reason of claims, demands or suits against it by third parties, resulting or alleged to have resulted from: acts or omissions of (Entity), its employees, agents, subcontractors or other representatives or from their presence on the premise of EKPC; from adverse impacts on EKPC's system, or other connected systems resulting from (Entity's) design, construction or operations of its facilities; or otherwise from performance of this Interconnection Agreement.

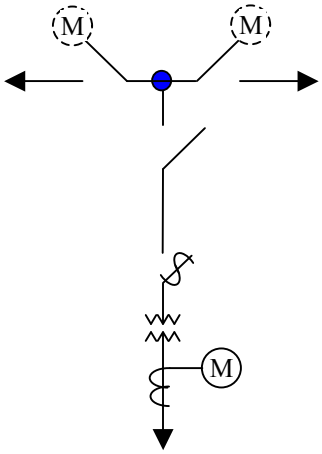
APPENDIX A

Figure 1 --Typical Transmission Tap Line Supply Configurations

Figure 2 – Typical Transmission Looped Supply Configurations (138 and 161 kV)

Figure 3 – Typical Transmission Looped Supply Configurations (345 kV)

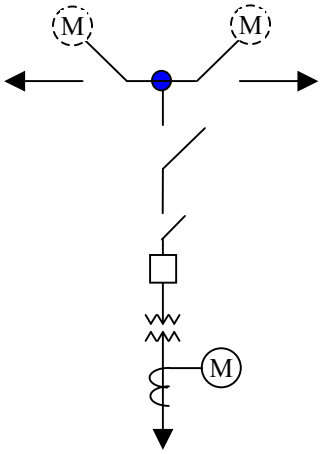
FIGURE 1 Typical Transmission Tap Line Supply Configurations



Transformers Under 10 MVA

Can Use Fuse Protection or Breaker Protection.

69 kV and below only.

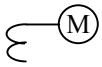


Transformers at 10 MVA or Larger And All Above 69 kV

Provide Circuit Breaker or Circuit Switcher Protection

(1) EHV End-User generally owns the step-down transformer
(2) EHV End-User Metering is typically installed on the low-side of the step-down transformer and compensated to the high-side to cover losses.
(3) All EHV and most >69 kV will have all facilities in a substation environment.
(4) Tap configurations without breaker(s) may not be suitable for some EKPC lines.

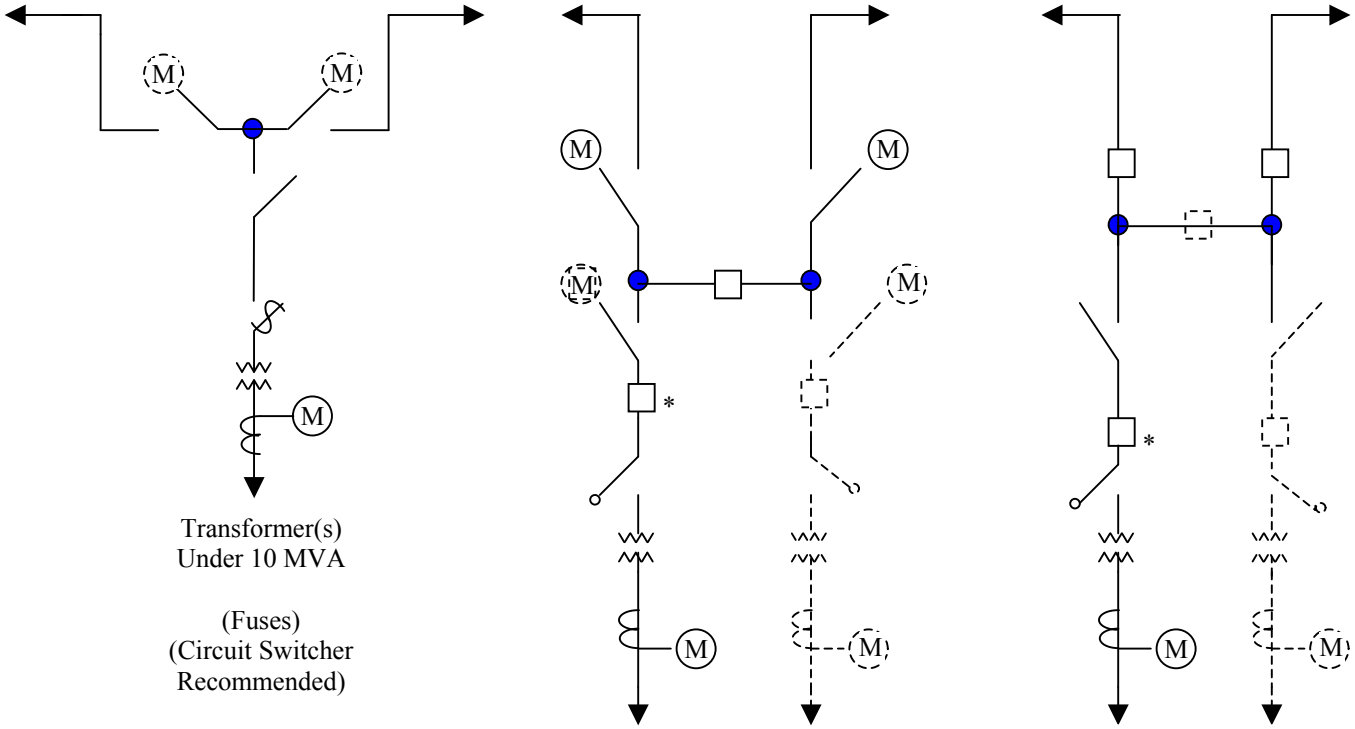
---------- Optional or Future



Metering

Motor Operated Air Break Switch

FIGURE 2 Typical Transmission Looped Supply Configurations (for 138 and 161 kV)

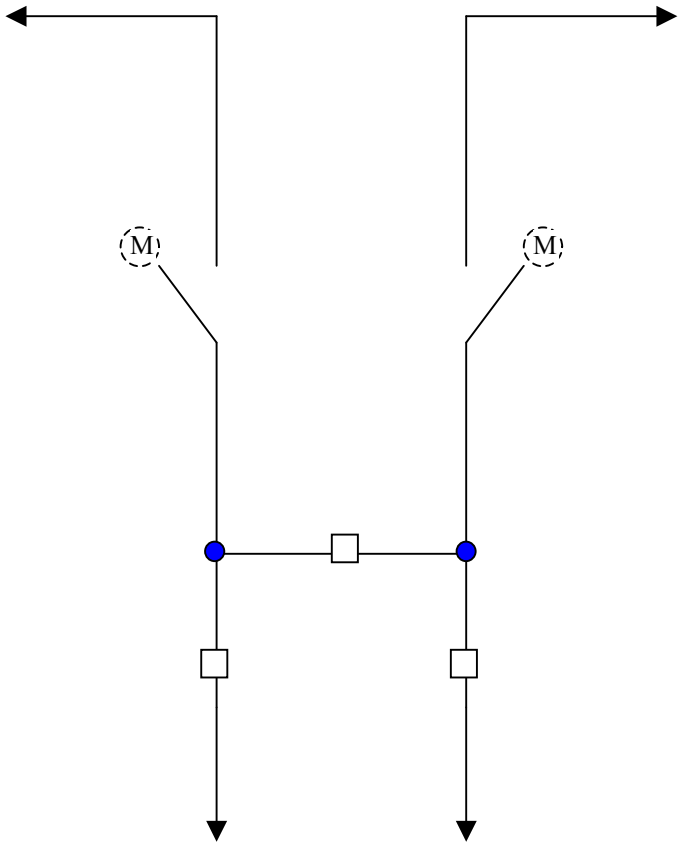


M Motor Operated Air Break Switch

---------- Optional or Future

M Metering

FIGURE 3 Typical Transmission Looped Supply Configurations (for 345 kV)



EHV End-User (1), (2)

---------- Optional or Future

Ⓜ Motor Operated Air Break Switch

(1) EHV End-User generally owns the step-down transformer.

(2) EHV End-User Metering is typically installed on the low-side of the Step-down transformer and compensated to the high-side to cover losses.

(3) All EHV switches and other equipment are to be in a substation.

APPENDIX B

Electrical Clearances and Equipment Ratings

NOTE:

INSERT APPENDIX B TABLE IN PLACE OF THIS PAGE

APPENDIX C

Switch Operator and Transmission Grounding Installations

APPENDIX C

Switch Operator and Transmission Grounding Installations

Reference to Drawings

All structures shall be grounded as shown on the TM-9SP or TM-9R and TM-9C drawings and subject to the following provisions.

Structure Grounding

1. East Kentucky Power (EKP) may require that ground resistance measurements be made for each structure and that additional grounding be added to that already provided by the basic structure grounding assembles.
2. Where structure grounding tests are required by EKP the Installer shall measure the ground resistance after the structure is erected, but before the overhead ground wire is installed. The method of measuring ground resistance shall be subject to the approval of EKP.
3. All labor and materials for ground resistance measurement and installation of additional grounding shall be provided by the Installer.
4. The Installer shall install counterpoise only after approval of EKP.

Bonding of Ground Wire

1. The pole wire shall be continuous and not spliced from top of pole to the pole butt grounding assembly. Should damage occur during erection of the structure, the pole ground wire may be spliced only with EKP approval.
2. Hardware shall be bonded to the pole ground wire as shown on the drawings. The ground wire shall clear any un-bonded hardware by at least 3 inches.

Special Requirements

1. Installer shall follow the EKP Single Pole or Two Pole Ground Configuration Procedures in order to achieve an acceptable grounding system.
2. Additional measures beyond the above procedures may be required in difficult locations. This may require special Engineering assessments.

NOTE:

INSERT THE FOLLOWING IN PLACE OF THIS SHEET:

Drawings: TM-9C, TM-9R, TM-9RH. TM-9HSP, TM-9R3P, TM-9SP, TM-9-3SP

Grounding instructions sheets Titled:

Single pole “X” Configuration
Two Pole Grounding Configuration

APPENDIX D

Inspection Requirements

Appendix D

CONNECTING FACILITY
Electrical Facility Checkout Guide

ITEM		ACTION/INFORMATION	BY	DATE
1. Facility Ground Resistance		Review Test Results	_____	_____
2. Air break and Disconnect Switch Alignment				
a. Switch Device Number	____	Visual Inspection	_____	_____
b. Switch Device Number	____	Visual Inspection	_____	_____
c. Switch Device Number	____	Visual Inspection	_____	_____
d. Switch Device Number	____	Visual Inspection	_____	_____
e. Switch Device Number	____	Visual Inspection	_____	_____
f. Switch Device Number	____	Visual Inspection	_____	_____
3. Circuit Breakers				
a. ___kV Circuit Breaker *Device Number* _____				
1. Gas Filled		Visual Inspection	_____	_____
2. Timing Test		Review Test Results	_____	_____
3. Digital Low R Ohmmeter		Review Test Results	_____	_____
4. Doble Test		Review Test Results	_____	_____
5. CT Ration & Polarity		Review Test Results	_____	_____
6. Breaker Alarms		Detailed Inspection	_____	_____
4. Circuit Switcher				
a. ___kV Circuit Switcher *Device Number* _____				
1. Hipot Test		Review Test Results	_____	_____
2. Timing Test		Review Test Results	_____	_____
3. Digital Low R Ohmmeter		Review Test Results	_____	_____
5. Fuses				
a. ___ kV Fuses *Device number* _____				
1. Rating/Type		Visual Inspection	_____	_____
2. Air Flow Test		Review Test Results	_____	_____
6. Power Transformer				
a. ___kV Transformer *Device Number* _____				
1. CT Ratio & Polarity		Review Test Results	_____	_____

2. Doble Tests	Review Test Results	_____	_____
3. TTR Tests (all Taps)	Review Test Results	_____	_____
4. Megger Tests	Review Test Results	_____	_____
5. Oil and DGA Tests	Review Test Results	_____	_____

7. CCVT/VT

a. ___kV *Circuit/Line Name* _____ *Device Number* _____

1. Doble Test	Review Test Results	_____	_____
2. Potential Polarizing Test	Review Test Results	_____	_____
3. Ration & Polarity Test	Review Test Results	_____	_____

b. ___kV CCVT/VT *Device Number* _____

1. Doble Test	Review Test Results	_____	_____
2. Potential Polarizing Test	Review Test Results	_____	_____
3. Ratio & Polarizing Test	Review Test Results	_____	_____

8. Phasing

a. _____ kV BUS *Number* _____

9. Batteries and Charger

a. _____V DC Battery and Charger

1. Battery Acceptable	Review Test Results	_____	_____
2. Intercall Resistance Test	Review Test Results	_____	_____
3. Charger Settings	Review Test Results	_____	_____
4. Ground Detector	Review Test Results	_____	_____

10. SCADA

a. Function Test with Dispatch/Control Center

1. Control	Detailed Inspection	_____	_____
2. Indication	Detailed Inspection	_____	_____
3. Alarms	Detailed Inspection	_____	_____

b. Metering	Detailed Inspection	_____	_____

c. Telemetering

1. Signal Levels	Review Test Results	_____	_____
2. Calibrations	Review Test Results	_____	_____

11. Relay and control Schematics

a. _____kV Circuit Breaker *Device Number* _____

1. Correct Settings Applied	Review Test Results	_____	_____
2. Calibration Test	Review Test Results	_____	_____
3. Trip Test	Detailed Inspection	_____	_____
4. In-Service Load Angles	Detailed Inspection	_____	_____
5. Remote Relay Communication	Detailed Inspection	_____	_____

b. Annunicators and Alarms

1. Set Undervoltage & Time Delay Relays	Review Test Results	_____	_____
2. Function Tested	Review Test Results	_____	_____

12. Miscellaneous

a. Arresters

1. Sized Correctly	Visual Inspection	_____	_____
2. Located Properly	Visual Inspection	_____	_____

b. Clearance

1. Bus to Ground	Visual Inspection	_____	_____
2. Bus to Bus	Visual Inspection	_____	_____
3. Bus to Steel	Visual Inspection	_____	_____

c. Conductors

1. Sized Adequately	Visual Inspection	_____	_____
2. Connected Properly	Visual Inspection	_____	_____