Transmission Facility Interconnection Procedures

Version 2

March 29, 2012

Applies to Ameren Missouri and Ameren Illinois
### NERC Reliability Standards Applicable to this Document

<table>
<thead>
<tr>
<th>Standard Number &amp; Revision</th>
<th>Registered Entity</th>
<th>NERC Functional Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>FAC-001-0</td>
<td>Ameren Services</td>
<td>Transmission Owner</td>
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<td>Transmission Planner</td>
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<td>Transmission Operator</td>
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### Document Approvals

<table>
<thead>
<tr>
<th>Title</th>
<th>Approved by</th>
<th>Signature</th>
</tr>
</thead>
<tbody>
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</tbody>
</table>

### Document Revision Status

<table>
<thead>
<tr>
<th>Version Number</th>
<th>Date Issued</th>
<th>Major changes from previous Version</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>NERC Requirement or Measure</th>
<th>Document Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1.2 Transmission facilities</td>
<td>Document as a whole</td>
</tr>
<tr>
<td>R2.1.1 Procedures for coordinated joint studies</td>
<td>Section 2 (Page 6)</td>
</tr>
<tr>
<td>R2.1.2 Procedures for notification of new or modified facilities</td>
<td>Section 10 (Page 10)</td>
</tr>
<tr>
<td>R2.1.3 Voltage level and MW, Mvar demand</td>
<td>Section 3 (Page 7)</td>
</tr>
<tr>
<td>R2.1.4 Breaker duty and surge protection</td>
<td>Appendix A, Section 2 a. 3). (Page 13)</td>
</tr>
<tr>
<td>R2.1.5 System Protection and coordination</td>
<td>Appendix A, Section 2 (Pages 12-14)</td>
</tr>
<tr>
<td>R2.1.6 Metering and telecommunications</td>
<td>Appendix A, Section 5 (Pages 14 and 15)</td>
</tr>
<tr>
<td>R2.1.7 Grounding and safety issues</td>
<td>Appendix A, Section 8 (Page 16)</td>
</tr>
<tr>
<td>R2.1.8 Insulation and insulation coordination</td>
<td>Appendix A, Section 4 (Page 14)</td>
</tr>
<tr>
<td>R2.1.9 Voltage, Reactive Power, and power factor control</td>
<td>Appendix A Section 3 (Page 14)</td>
</tr>
<tr>
<td>R2.1.10 Power quality impacts</td>
<td>Appendix A, Section 1 (Pages 11 and 12)</td>
</tr>
<tr>
<td>R2.1.11 Equipment Ratings</td>
<td>Appendix A, Section 6 (Page 16)</td>
</tr>
<tr>
<td>R2.1.12 Synchronizing of facilities</td>
<td>Appendix A, Section 7 (Page 16)</td>
</tr>
<tr>
<td>R2.1.13 Maintenance coordination</td>
<td>Appendix A, Section 9 (Page 16-17)</td>
</tr>
<tr>
<td>R2.1.14 Operational issues (abnormal frequency and voltages)</td>
<td>Not applicable to transmission facility interconnections</td>
</tr>
<tr>
<td>R2.1.15 Inspection requirement for existing or new facilities</td>
<td>Appendix A, Section 11 (Page 17)</td>
</tr>
<tr>
<td>R2.1.16 Communications and procedures during normal and emergency operating conditions</td>
<td>Appendix A, Section 12 (Page 17-18)</td>
</tr>
<tr>
<td>R3 Maintain and update facility connection requirements as required. Make documentation of requirements available to users of transmission system, SERC, and NERC on request within 5 business days.</td>
<td>Section 1 (Page 6)</td>
</tr>
</tbody>
</table>
# Document Distribution List

<table>
<thead>
<tr>
<th>Recipient</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmission Policy &amp; Planning</td>
<td>Ameren Services</td>
</tr>
<tr>
<td>Operations Planning Group</td>
<td>Ameren Services</td>
</tr>
<tr>
<td>Transmission Operations</td>
<td>Ameren Services</td>
</tr>
<tr>
<td>T&amp;D Design Groups</td>
<td>Ameren Services</td>
</tr>
<tr>
<td>System Protection Groups</td>
<td>Ameren Services</td>
</tr>
<tr>
<td>Reliability Standard Compliance</td>
<td>Ameren Services</td>
</tr>
</tbody>
</table>
TABLE OF CONTENTS

1. Introduction .................................................................................................................. 6
2. General Requirements .................................................................................................. 6
3. Making Interconnection Request ................................................................................. 7
4. Cost to Study Interconnection ..................................................................................... 8
5. Receiving Request and Agreement to Perform Study .................................................. 8
6. Provide Opportunity for Entity to Make Comments .................................................... 9
7. Entity Determines Value of Interconnection ................................................................. 9
8. Interconnection Agreement .......................................................................................... 10
9. Internal Release of New Project .................................................................................. 10
10. Notification to Neighboring Electric System of Interconnection ................................. 10
11. Notification by Entity to Company Regarding Changes to Existing Connection(s) ...... 10

Appendix

1. Power Quality Impacts ................................................................................................. 11
2. System protection and Coordination ......................................................................... 12
3. Voltage and Reactive Power Considerations .............................................................. 14
4. Insulation, Insulation Coordination, Surge Protection, and Shielding ....................... 14
5. Metering and Telecommunications ............................................................................. 14
6. Equipment Ratings .................................................................................................... 16
7. Synchronizing of Facilities ......................................................................................... 16
8. Grounding and Safety Issues ...................................................................................... 16
9. Maintenance Coordination ........................................................................................ 16
10. Operational Issues .................................................................................................... 17
11. Inspection Requirements for Existing or New Facilities ............................................ 17
12. Communications and Procedures during Normal and Emergency Operating Conditions 17
13. Electrical equipment to be furnished by the Transmission Facility owner and by Ameren 18
1. Introduction
A transmission system is defined as those electrical system facilities that do not satisfy the FERC seven factor test for determining distribution facilities and are not generator GSUs or lead lines and associated equipment. A transmission facility interconnection to the Ameren transmission system (“Transmission System”) is a facility that connects the Ameren transmission system to another entity’s transmission system. In addition to the steps contained herein, a transmission facility interconnection to the Transmission System must be in compliance with any applicable provisions of the MISO Tariff (OATT).

The following information provides general procedures and the requirements for connecting transmission facilities to the Transmission System. If this interconnection includes generation that will NOT inject power into the Transmission System and will not operate in parallel with the Transmission System under ANY circumstance, then the MISO Tariff - Attachment X: Generator Interconnection Procedure (GIP) will not apply. If an interconnection includes generation that MAY or WILL inject power into the Transmission System or could operate in parallel with the Transmission System, then the MISO Attachment X: Generator Interconnection Procedures (GIP) will apply. In either case, these “Transmission Facility Procedures and Requirements” must still be followed where applicable.

This document will be reviewed every 3 years or as appropriate for possible revision. The existing or revised document will be re-certified. Ameren shall make documentation of these requirements available to the users of the Transmission System, SERC, and NERC upon request within five business days.

2. General Requirements

The requirements under these Transmission Connection Procedures apply to all new transmission facilities, whether requested by Ameren (hereinafter referred to as “Company”), or a third party, connecting to the Transmission System. Transmission Facility connections shall comply with all applicable codes, standards, government regulations, environmental regulations, siting requirements, contracts, operating agreements, and tariff requirements related to the proposed transmission facility. All planning, design, construction, maintenance, and operation of the transmission facilities which will be owned by Ameren and which would become an integral part of the Ameren Transmission System as a result of this connection, must be performed through Ameren. Ameren follows applicable NERC Reliability Standards and SERC Regional Criteria or their successors. Material changes to existing connections are also governed by the requirements under these Transmission Connection Procedures.

Ameren will perform coordinated joint studies of the new facilities to investigate their impacts on the Transmission System. The results of such studies will be provided as joint recommendations from all parties involved with the study. The provisions of the
following sections 3 through 5A would be waived if Ameren determines it is in its best interest to pursue the coordinated study of the new facilities.

3. Making Interconnection Request

When an entity requests a new transmission facility interconnection to Company’s Transmission System, that entity must submit a request in writing. Such a request should be sent to:

Manager, Transmission Policy & Planning
Ameren Services Company
P.O. Box 66149, MC 635
St. Louis, MO 63133-6149

Telephone No. (314) 554-2238
Fax Telephone No. (314) 206-0600

The facilities applicable to these Transmission Connection Procedures are those that affect the Transmission System, i.e., are not classified as distribution facilities under the FERC seven-factor test. The likely voltage levels that are possible for consideration as transmission on the Ameren system are 138 kV, 161 kV, 230 kV, and 345 kV. As noted above, requests to connect Entity’s generation to the Transmission System may be controlled by the MISO Tariff. When an entity decides to pursue a generation connection that will operate in parallel with or if power will be injected into the Transmission System, that entity must follow the requirements of the MISO Tariff – Attachment X: Generator Interconnection Procedures.

The request must include:

- Voltage level of Interconnection facilities;
- Location of the proposed interconnection;
- Identification of the location on the Transmission System to which Entity desires to connect and the voltage at that location;
- Proposed In-service Date;
- Entity’s study report showing reasons for a new interconnection on Ameren’s system;
- Customer generation, if any; state intended use; i.e., wholesale or self-use, whether the generation will operate in parallel with the Transmission System and if there is any possibility to inject power into the Transmission System (Note that MISO Tariff – Attachment X: Generator Interconnection Procedures may apply);
- Description of Power flow model used in their analysis. Make model data available to Ameren upon request; and
- Other information as appropriate.
4. **Cost to Study Interconnection**

Entity shall pay the actual cost of Ameren’s engineering time to evaluate the impact(s) of Entity’s proposed connection to the Transmission System. Ameren will assess Entity for all applicable charges related to the evaluation. The hourly charges for engineering services will be assessed at the prevailing rate of such engineering work. If Entity proceeds with the interconnection to the Transmission System, Ameren will send Entity an agreement for execution (“Study Agreement”) specifying the scope and estimated cost and time to perform a study of the impact of the interconnection on the Transmission System.

5. **Receiving Request and Agreement to Perform Study**

A. Upon Ameren’s receipt of the fully executed Study Agreement, along with the Section 3 information above, Ameren will perform an analysis of the requested connection in a timely fashion. The Study Agreement will identify the assumptions for the study and the analysis to be accomplished by Ameren. Upon receipt of the executed Study Agreement, Ameren will start the work defined in the Study Agreement.

B. The initial analysis will consist of power flow modeling. The system performance evaluation will be based on NERC Reliability Standards TPL-001 through TPL-003 as a minimum, and the Entity’s and Ameren’s “Transmission Planning Criteria and Guidelines” if more restrictive. If applicable, short circuit modeling, stability, or other analysis such as a switching study or EMTP study will be performed, under an addendum to the Study Agreement. Such additional analysis will also be based on NERC Reliability Standards TPL-001 through TPL-003 as a minimum and the Entity’s and Ameren’s “Transmission Planning Criteria and Guidelines” if more restrictive.

Transmission interconnections are handled on a case by case basis. The basis for the connection requirements is Ameren’s “Transmission Planning Criteria and Guidelines”, which are included in the most recent FERC 715 filing. This document includes criteria for general transmission planning as well as transmission interconnection planning. Evaluation of the impact of Entity’s connection to the Transmission System is also governed by the criteria outlined in applicable NERC Reliability Standards.

Ameren will review the results of the power flow analysis for selected alternatives based on the agreed to assumptions. This review is to make sure that Entity and Ameren are mutually in agreement with the assumptions and the direction in which the study is headed while studying the possible engineering alternatives.

C. Ameren will provide a draft report on the results of its analysis that identifies the Entity’s interconnection requirements. In addition to these general connection requirements, the Entity will be required to adhere to the following requirements, as appropriate and applicable, and include in their facility design engineering specifications that will allow adherence to these requirements\(^1\):

\(^1\) These requirements are based upon NERC Reliability Standard FAC-001-0.
1) Power Quality impacts
2) System protection and coordination
3) Voltage and Reactive Power Considerations
4) Insulation, Insulation Coordination, Surge Protection, and Shielding
5) Metering and telecommunications
6) Equipment ratings
7) Synchronizing of facilities
8) Grounding and safety issues
9) Maintenance Coordination
10) Operational issues (jurisdictional and functional authority)
11) Inspection requirements for existing or new facilities
12) Communications and procedures during normal and emergency operating conditions
13) Electrical equipment to be furnished by the Transmission Facility owner and by Ameren.

See the Appendix for a description of the above items.

Ameren reserves the right to design, build, construct, own, operate, and/or maintain, any equipment that becomes part of the Transmission System or that can have an impact on the Transmission System as a result of the Entity’s interconnection.

6. Provide Opportunity for Entity to Make Comments

The Entity will be given an opportunity to respond to Ameren’s draft report and requirements. Upon receiving the Entity’s comments, Ameren will work with Entity to resolve the issues resulting from Entity’s comments if possible. After resolving the appropriate issues, Ameren will issue a final report of the study including the conditions under which this requested interconnection will be allowed and the cost of the facility additions and/or modifications that Company is making if any to its Transmission System to accommodate Entity’s interconnection, whether such additions and/or modifications are due to thermal, voltage, short-circuit, stability, or other related considerations. For those facilities for which Entity will be charged and Ameren will purchase and own, the cost will include an income tax gross-up of approximately 34%, or latest applicable rate, for those facilities for which Entity will provide reimbursement.

7. Entity Determines Value of Interconnection

If Entity wishes to proceed with the interconnection, Ameren will work with Entity to place the required facilities in service in accordance with a mutually agreed schedule. If Entity does not wish to pursue the transmission interconnection, the remaining charges for any study services will be billed to Entity and Ameren’s involvement will end upon receiving payment.
8. Entity Interconnection Agreement

Once Entity decides to proceed with the interconnection, Ameren will prepare and forward for execution an agreement describing the terms and conditions under which Entity can interconnect to the Transmission System (“Interconnection Agreement”). The Interconnection Agreement identifies the specific facilities that would be provided by both parties. Included in this agreement would be a description of the point of interconnection, a one-line diagram of facilities, and a requirement that Entity adheres to the applicable requirements specified in section 5 on pages 8 and 9 and as detailed in the Appendix to this document.

The party proposing the change to the configuration of the Transmission System as a result of the interconnection will be responsible for bearing the costs associated with the interconnection.

9. Internal Release of New Project

Once the Interconnection Agreement has been executed, a Job Description is issued internally to inform other groups within Ameren that agreement has been reached on new facilities, to inform them on the nature of the new facilities, and to specify the in-service date. The Job Description also informs the electrical engineering and design groups within Ameren of the conceptual design of the new facilities so that these groups can begin detailed engineering, design, and material procurement.

10. Notification to Neighboring Electric System of Interconnection

If Entity agrees to proceed with an interconnection to the Transmission System, Ameren will contact owners of neighboring electric systems as appropriate to inform them of the future interconnection. At that time, Ameren will also make available to these neighboring electric systems a copy of the final report upon request. If sensitive information is contained in the report, those sections will be eliminated from the report.

11. Notification by Entity to Ameren Regarding Material Changes to Existing Connection(s)

Entity shall notify Ameren of any Entity changes or modifications that are planned to occur which may affect the Transmission System, system operations or reliability. To facilitate updating system studies involving the connection(s), Entity is required to provide information in a timely manner on such changes to the contact identified under Section 3.
Appendix

Description of Requirements for Connection

1. Power Quality Impacts

In general, the connection of the Entity to the Transmission System should not unacceptably compromise or degrade the power quality provided to existing customers. If necessary, installation of power quality monitoring equipment by Ameren at Entity’s expense will be required to verify compliance with power quality performance requirements.

   a. Harmonic Requirements: The harmonic content of the voltage and current waveforms injected into the Ameren’s Electric System by Entity’s facility shall be restricted to levels that are in accordance with the latest version of IEEE Standard 519 or its replacement and which will not cause excessive distortion of Ameren’s waveform, telephone interference, carrier interference or equipment operating problems for Ameren or other users of the Transmission System. Entity will, if required by Ameren and/or Good Utility Practice, reduce or eliminate, at Entity’s expense, the existence of any excessive harmonics caused by the operation of the Entity’s facility.

   b. Flicker Requirements: The acceptability of the voltage fluctuations caused by varying or switched loads, switched capacitors, motor starts, and other normally occurring events, which produce a sudden change in voltage, depends upon the frequency and magnitude of the fluctuation of flicker. Most cases are evaluated with established flicker curves. Arc furnaces, however, are evaluated differently as noted below.

   i. Flicker sources other than arc furnaces
      The flicker limits developed and published in the latest version of IEEE Standard 1453 are used as a general guide for evaluating the acceptability of expected flicker from causes other than arc furnaces. These limits show permissible flicker levels as a function the frequency of occurrence.

   ii. The primary criteria for evaluation of the expected flicker from an arc furnace load on the Transmission System is based upon the charts presented in IEEE Standard 519-1992. These charts indicate whether the resultant flicker would be Objectionable, Borderline, or non-Objectionable based on the furnace size and system impedance supplying the furnace(s). For a furnace installation to be rated “acceptable”, the flicker with normal system conditions must be in the “non-Objectionable Flicker Zone” on the charts. This method does not consider the electrical characteristics of the particular furnace involved, other than the basic load rating. An evaluation method developed and presented in the ASEA Journal 1976, Volume 49, factors in the electrical characteristics of the furnace by specifying a maximum allowable voltage drop on the critical
bus during a transition from an unloaded furnace to a 3-phase fault at the furnace electrodes. According to this study a calculated voltage dip of 2.0% is considered marginal.

2. System Protection and Coordination

Ameren requires that its Transmission System be protected from damage and that System reliability be maintained. Thus, Ameren will unilaterally determine what protection and coordination facilities are required and the ownership of these protection facilities for all connections to the Transmission System. Such coordination, including any remote tripping schemes, underfrequency or undervoltage load shedding schemes, or special protection systems, will be required regardless of the location of the Entity’s connection with respect to boundaries of Balancing Authority Areas. Ameren will perform or cause to be performed all appropriate study work related to Customer’s connection.

General principles to be followed in designing and operating the Protection System equipment include:

- Public Safety
- Prevention/minimization of equipment damage
- Minimization of equipment outage time
- Minimization of system area exposed to outage
- Minimization of system voltage disturbances
- Adequate protective system coverage for abnormal conditions

For the following devices, Entity is responsible for paying for these facilities, but Ameren may be the ultimate owner. For those facilities that Ameren will own and for which Entity pays, Ameren will perform installation, operation, and maintenance. Following are requirements for the protection devices:

a. Disconnecting and Interrupting Devices: Entity shall provide at a location or locations agreed to by Ameren a disconnecting and interrupting device or devices which:

1) Provide a manually operated visible disconnecting device as a means of electrically isolating Entity’s facility from the Transmission System. The manually operated disconnecting device shall have a means for locking the device in the open position with Ameren’s padlocks.

2) Provide automatic isolation of the Entity’s system from the Transmission System for faults or abnormal conditions on Entity’s system so as to maintain network flow and reliability to the Transmission System, and
3) Provide automatic isolation of the Entity’s system from the Transmission System for faults or abnormal conditions on the Transmission System so as to protect Entity’s facilities from faults or abnormal condition on the Transmission System.

Interrupting devices must have sufficient interrupting capacity to interrupt the ultimate fault current at each device location. Ameren reserves the right to require Entity to open all interrupting devices Ameren deems necessary to fulfill the power and authority granted to Ameren under the terms of the “Interconnection Agreement”, and upon such a request by Ameren, Entity shall open such interrupting devices immediately.

b. Fault and Loss of Utility Protection: Entity shall provide, install, operate and maintain all of the protection and control devices required by Ameren, in accordance with Good Utility Practice, to safely, efficiently and reliably integrate Entity’s facility with Ameren’s Transmission System. The protection and control devices required by Ameren shall include, but not be limited to the following: i) main fault protection relay(s) and associated equipment capable of detecting a fault within Entity’s facility and automatically isolating Entity’s facility from the Transmission System when such faults occur; ii) fault protection relay(s) and associated equipment capable of detecting faults on the Transmission System and automatically isolating Entity’s facility from the Transmission System to prevent the facility from contributing to such faults; and iii) loss of Transmission System supply relay(s) and associated equipment capable of detecting Transmission System isolation events and isolating Entity’s facility from the Transmission System to prevent unsafe or unreliable feedback from Entity’s facility into the Transmission System. All of the relays required for safe, efficient and reliable operation of the facility with the Transmission System shall be equipped with built-in test provisions. Entity’s protection systems shall be designed with adequate redundancy to meet the above requirements under the single contingency loss of a protective relay, CT or VT circuit, DC circuit, auxiliary or lockout relay, or protection system communications equipment.

c. Transmission Tap Protection: In some circumstances, installation of a disconnecting and interrupting device at the location at which Ameren’s transmission system is tapped may be necessary. The need for this equipment will be determined unilaterally by Ameren. Such circumstances would include:

1. Protection system limitation or requirements
2. Length of transmission line extension to Entity’s facility would involve a significant increase to Ameren’s transmission line length or outage exposure to Ameren facilities.
d. **Additional Protection for Entity’s Facility:** If Entity desires a greater level of reliability, such as multiple supplies or ring bus supply, additional system protection equipment required would be installed at Entity’s expense.

3. **Voltage and Reactive Power Considerations**

Coordination of the operation of Entity’s and Ameren’s reactive compensation devices near the point of interconnection needs to be considered. Transmission interconnected equipment should be able to accommodate the Transmission System’s reactive power flow requirements.

4. **Insulation, Insulation Coordination, Surge Protection, and Shielding**

BIL (Basic Impulse Level) should be commensurate with Ameren standards. Entity transmission facilities shall be shielded from direct lightning strikes in accordance with Ameren standards and the latest version of IEEE Standard 998 “Guide for Direct Lightning Stroke Shielding of Substations”. Substation non self-restoring insulation, if applicable, should be protected against incoming surges per latest version of IEEE C62.22.

In addition, for Entity transmission line taps and line structures with multi-grounded lightning protection wires, the individual structure footing resistances shall be commensurate with Ameren standards. Also, it is preferred that two shield wires be employed to shield transmission lines from direct lightning strikes.

5. **Metering and Telecommunications**

a. **Entity shall provide,** install, and maintain in accordance with Good Utility Practice and Entity’s expense metering equipment including but not limited to revenue quality interchange metering, at a point or points agreed to by both Entity and Ameren, capable of measuring the instantaneous, hourly and total amount of energy being delivered to or received from the Entity’s facility from Ameren’s Transmission System.

b. **Entity will provide,** install, own and maintain in accordance with Good Utility Practice equipment to telemeter the following data continuously from the metering equipment to Ameren using Harris 5000 protocol, or if agreed to by Ameren, its operational equivalent:

   - Real power in megawatts (“MW”);
   - Reactive power in megavolt-ampere-reactive (“MVar”);
   - Current in Amperes
   - Voltage in kV
Ameren may release Entity from this obligation if such data is not needed for operations. The decision will solely be Ameren’s. Ameren will confirm this release in writing. In the absence of any such letter from Ameren, Entity will comply with the requirements of this paragraph b).

c. Entity shall test the metering equipment at least one (1) time each calendar year at Entity’s expense and at any other mutually agreeable and reasonable time requested by Ameren at Ameren’s expense. Entity shall provide Ameren with at least fourteen (14) calendar days advance notice of any testing to be performed on the metering equipment, and Ameren shall have the right to be present during all such testing and shall be furnished with all testing results in a timely manner. Ameren shall make no further dissemination of meter reading data to third parties other than the Regional Transmission Operator (“RTO”) to which they are associated. Ameren may require that the meter and metering equipment be sealed with Ameren provided seals along with any seals required by the Entity.

d. Metering equipment shall be considered accurate if the meter error percentage does not exceed plus or minus three tenths of one percent (+/- 0.3%). If testing of the metering equipment reveals any measurement inaccuracies greater than the meter error percentage permitted above, the affected metering equipment shall be recalibrated, repaired or replaced promptly by Entity such that any such measurement inaccuracies are rectified. If either Entity or Ameren believes that there has been a meter inaccuracy, failure, or stoppage, they shall immediately notify the other.

Entity is responsible, at Entity’s cost, to confirm that instrument transformer error percentage of the metering CT’s and PT’s remains less than +/- 0.3%.

e. Additional design requirements that should be addressed with the SCADA and metering equipment as appropriate for Entity’s connection include:
   - Loss compensation
   - Bi-directionality
   - Ancillary equipment specification (such as CT’s and PT’s)
   - Mode of data transmission (such as fiber optic cable, phone line, etc.)
   - Control functionality (breakers, switches, etc.)
   - Provisions for maintaining continuity and meeting reliability criteria (such as dual DC sources, dual port RTUs)

f. If, for any reason, any metering equipment is out-of-service or malfunctions so that the amount of energy delivered cannot be ascertained or computed from the readings thereof, the energy delivered or received during the period of such outage shall be estimated and agreed to by both Entity and Ameren upon the best data available, including, but not limited to, other meters,
operational logs, and real-time communications data of the meter results, as mutually determined by the Entity and Ameren.

g. At intervals requested by Ameren and upon reasonable advance notice, Entity shall provide to Ameren actual readings of the metering equipment to verify the accuracy of the metering equipment data being telemetered to Ameren.

h. Entity is responsible for the telecommunications circuit, details of which will be specified by Ameren.

6. Equipment Ratings - The MVA and current rating of all equipment from the Ameren point of ownership to the Entity’s first supply bus are required. This information is used to coordinate protection of the Transmission System. Applicable industry standards (ANSI/IEEE) shall be used to determine ratings of the equipment. Ameren’s general design parameters and practices shall be identified and adhered to. Any special requirements due to atmospheric, geological, seismic, or environmental conditions should also be addressed.

7. Synchronizing of Facilities – Sync-check relaying equipment may be required if the power phase angle is greater than 15 degrees. If the Entity has generation that will operate in parallel with or will inject power onto the Transmission System, the requirements in the MISO Tariff under Attachment X: Generation Interconnection Procedures shall apply. If there is absolutely NO possibility that Entity’s generation shall operate in parallel with nor inject power into the Transmission System, the MISO Tariff – Attachment X: Generation Interconnection Procedures shall not apply.

8. Grounding and Safety Issues – Ameren has minimum grounding and safety requirements that the Entity must meet so that the Entity operates its facility in accordance with National Electric Safety Code. Design requirements for system grounding that should be addressed as appropriate for Entity’s connection include:
   - Grounding study
   - Compatibility with the Transmission System
   - Interconnection of grounding system to Ameren’s grounding system(s)
   - Transmission line shielding provisions
   - Arrester applications
   - Cathodic protection

9. Maintenance Coordination. Ameren is responsible for regular maintenance on all Ameren-owned Transmission System equipment. Entity’s maintenance practices for their transmission-connected equipment should be performed at a level that ensures the reliability of the Transmission System. Definition of maintenance programs and performance objectives, as appropriate, should be addressed with Entity’s connection. When maintenance is scheduled, consideration needs to be given to generation maintenance, dispatch schedules, and transmission transactions which could be affected, as well as maintenance which may be performed concurrently on nearby transmission facilities which could have an adverse effect on local area voltages or the status of
protection schemes. All necessary authorizations, notifications, and clearances relevant to the maintenance work to be performed must be obtained.

The facility owner, whether Ameren or Entity, is responsible for the regularly scheduled calibration and/or maintenance of its equipment associated with the connection, as applicable, including, but not limited to:

- Circuit breakers
- Power transformers
- Protective relays
- Revenue metering
- Communications
- Trip circuits
- Interrupters
- Power DC sources
- Grounding system
- Transmission facilities

Relevant records of maintenance work performed should be maintained.

10. Operational Issues (Jurisdictional and Functional Authority) Note: Jurisdictional Authority is an operating authority whereby the holder is in charge of and responsible for directing and coordinating operation of system equipment. Functional Authority is an operating authority whereby the holder specifically performs or directs someone else to perform detailed switching operations.

- Ameren will have Jurisdictional Authority over the protection and disconnecting devices on the transmission facility interconnection.
- In general, the Entity will have Functional Authority on their equipment in their substation and in their facility.
- Ameren will have Functional Authority on all Ameren equipment, except as conferred in writing to Entity by Ameren.

11. Inspection Requirements for Existing or New Facilities – Commissioning Testing and Inspection. For those relays protecting Ameren’s equipment, Ameren reserves the right to witness testing of relays, breakers, instrument transformers, communications equipment, and DC station service prior to commencement of commercial operation. Ameren reserves the right to specify additional testing as appropriate, with Entity to modify operations as necessary to reasonably comply with Ameren’s testing requirements. Entity’s electrical equipment will be made available to Ameren for inspection upon two day written request during nonemergency conditions.

12. Communications and Procedures During Normal and Emergency Operating Conditions – The Entity shall provide Ameren with employee contacts for normal conditions and emergency situations and shall keep this information updated. These contact person(s) shall have the authority and capability to operate Entity’s facilities according to the instructions or directives of the appropriate Ameren operating authority.
All Transmission Operators (entities responsible for the reliability of the Transmission System, and that operate or direct the operations of the transmission facilities) shall obtain proper clearances from the appropriate operating authority before commencing any work on the transmission facilities. All Transmission Operators shall have a provision for reliable communications with the appropriate operating authority. In addition, all Transmission Operators shall have provisions for reliable communications with other Transmission Operators as appropriate.

Entity shall communicate with and shall cooperate with Ameren to support recovery efforts during emergency conditions. Such actions Entity may be called upon to take may include, but are not limited to, implementation of emergency communications procedures, switching operations, tripping of or starting of generating units, changes to status of reactive power support devices, and transmission facility restoration efforts.

13. **Electrical equipment to be furnished by the Transmission Facility owner and by Ameren** – Ameren will determine the electrical equipment requirements for the interconnection on the basis of its criteria and guidelines along with good utility practices and general management directives. The responsibility for bearing the cost of the new equipment to be installed and any necessary modifications to existing equipment as a result of increased loading or increased fault duty will be determined by mutual agreement of all the parties involved.