

AECC Design and Operating Requirements
For
Interconnected Facilities

In addition to the rules and standards set forth by the APSC, FERC and NERC, AECC and its member cooperatives have certain requirements that must be met before an interconnection can be completed. These requirements are focused primarily on the details pertaining to the design, equipment, protection, and metering. Operations, operational issues, maintenance coordination, inspection, and communications are also addressed. Many of these requirements are outlined in the documentation and agreements that are a part of the interconnection process. These requirements are subject to change without notice.

All interconnections will be subject to the design requirements described below. Due to AECC's interconnected nature with the Entergy, AEP, and SWPA systems, AECC may require interconnecting facilities to the AECC system to adhere to the requirements of Entergy, AEP, and SWPA as applicable. In these requirements, the appropriate Entergy and AEP documents have been referenced and are subject to change without notice. Any additional requirements included in member cooperative line extension policies may also apply. Furthermore, interconnections will meet the requirements of the NERC standards and SPP Criteria.

Because we are connected to the Entergy, AEP, and SWPA transmission systems and are under their interconnection requirements, joint studies might be conducted by them in conjunction with AECC or as an independent process to determine the indirect effect that might occur due to the new connections. Where joint studies might be necessary, it is the customer's responsibility to provide all information necessary to AECC and all affected parties needed to conduct thorough and complete studies. [NERC FAC-001R2.1.1]

At any time, it is the customer's responsibility to notify AECC and any affected parties of any changes, modifications, or additional new facilities while in their conceptual or planning phase. This will allow the appropriate adjustments to be made to the current study process in a timely manner such as to ensure that the proposed changes do not significantly alter the effects of the original interconnection request. If the changes do result in a significant difference from the original intent, then a separate interconnection request may be required. [NERC FAC-001R2.1.2]

In addition, AECC will require the following [NERC FAC-001R2.1]:

- Any entity connecting to AECC owned transmission lines or substations shall as a minimum meet the requirements of the National Electrical Safety Code at the time of installation and employ good utility practice when designing their facilities. AECC, at its sole discretion, may refuse interconnection of any requesting entity should the proposed design not exhibit good utility practice.

- Facility designs shall be submitted to AECC preferably with the interconnection request and approved by AECC before construction begins.
- AECC will review interconnection facility designs on a case-by-case basis to determine appropriate levels of protection and control for the interconnection facility.
- Interconnecting facilities which may impact power quality, such as contributing harmonics and/or flicker, will be required to mitigate such impacts and control them within limits established by AECC.
- All interconnecting facilities will be designed and constructed utilizing utility grade equipment which may include but not limited to, utility grade relaying, breakers, switches, metering, grounding, and controls.
- If any interconnecting customer should fail to maintain its lines, equipment and other facilities in accordance to standards and prudent utility practices AECC shall have the right to discontinue receipt of electric power to the facilities in question after giving notice of its intention to do so.
- AECC may require the requestor to meet certain requirements in areas listed below. These requirements unless otherwise documented will be required on a case by case basis and discussed with the requestor before the interconnection request is approved.
 - Voltage level, Mw and Mvar capacity or demand at the point of interconnection [NERC FAC-001R2.1.3]
 - Interconnections which result in voltages below 95% of nominal or above 105% of nominal on AECC or its member cooperatives' facilities will not be allowed. If an interconnection is expected to cause voltages outside the range specified above, adjustments to the interconnection will need to be made in order to bring the voltage within this range.

The following may also apply:

Entergy: PM3901 Rev 7, §5.10; Voltage Schedules; SL0002, latest revision; SL1904, Latest Rev.

AEP: TP-0001 Rev. 0 §4.3.1, 5.1.1 (See note below)

- Breaker duty & surge protection [NERC FAC-001R2.1.4]
 - Circuit breaker duty and design criteria are found in Appendix A. Certain interconnections may require higher interrupting and/or continuous current ratings.
 - Surge protection devices will be installed on the interconnecting customer's facilities such that they eliminate or sufficiently reduce the likelihood of damage to AECC's and its member cooperatives' facilities due to voltage surges.
 - Interconnecting customers shall install surge protection on the high and low side of power transformers. If the facility does not have a transformer, each line terminal shall have arresters installed. Surge arresters shall be station class and have voltage ratings for grounded circuits as follows:

60kV for 69kV systems
96kV for 115kV systems

108kV for 138kV systems
 132kV for 161kV systems

▪ Circuit Breaker Design Criteria

| Minimum Design Criteria | Units | Breaker Voltage | | | |
|-------------------------|--------|-----------------|--------------|--------------|--------------|
| | | <i>69kV</i> | <i>115kV</i> | <i>138kV</i> | <i>161kV</i> |
| Max L-L voltage | kV | 72 | 123 | 145 | 170 |
| Nominal L-L voltage | kV | 69 | 115 | 138 | 161 |
| Continuous Current | A | 1200 | 2000 | 2000 | 2000 |
| Short Circuit Interrupt | kA | 40 | 40 | 40 | 40 |
| BIL | kV | 350 | 550 | 650 | 750 |
| Max Interrupt Time | Cycles | 5 | 3 | 3 | 3 |

- The switching of loads, motors, capacitors, etc. shall not cause excessive voltage surges to occur on the AECC/Member Cooperative system. The point at which a switching surge is considered excessive shall be considered on a case by case basis considering the equipment that is affected. Switching surges may also be referred to as transients or voltage transients.
 - Capacitor Banks – Switching surges affecting only capacitor banks shall not exceed amounts given in ANSI C18-1992.
 - Variable Frequency Drives – Switching surges affecting Variable Frequency Drives or other customer equipment shall not exceed amounts recommended by the manufacturer of that equipment (usually 1.2-1.3 pu). If feasible, the addition of line reactors to such drives may be necessary.
 - Other equipment – Capacitor banks placed on the primary system may interact with customer’s capacitor banks on the secondary. A situation that may arise is referred to as voltage magnification, in which case the voltage rise on the secondary bus is much greater than the rise on the primary bus that the capacitor switching originated. If this situation is deemed to exist, it affects all customer equipment on such bus. Conversion of customer’s capacitor banks to harmonic filters is effective for control of this magnification problem.

The following may also apply:

Entergy: PM3901 Rev 7, §5.8.2, 5.8.3, 5.8.7; SL0002 Latest Rev.

AEP: TP0001 Rev 0, §7.18.

- System protection & coordination [NERC FAC-001R2.1.5]
 - In emergency cases only, authorized personnel from AECC and its member cooperatives must have access to and permission to operate the first air break disconnect switch at the point of connection with Coop Facilities. AECC or its member cooperative shall notify the designated interconnecting customer's representative as soon as reasonably possible after such operation, giving details as to the necessity and time of operation.
 - The interconnecting customer shall submit a single line diagram of the proposed interconnection's protective relaying design for review and approval by AECC before such equipment is installed.
 - The interconnecting customer shall provide relay data and settings to AECC for coordination study purposes.
 - For generation facilities operated in parallel with Coop Facilities, the user must provide protective devices capable of sensing a problem on Coop Facilities and disconnecting the generator from Coop Facilities. AECC will review the user's plans for these protective devices to ensure that they are adequate. AECC's review does not imply that the user's protective devices meet the requirements of Other Applicable Standards.
 - For generation facilities operated in parallel with Coop Facilities, the user will ensure that the generator is disconnected from Coop Facilities if an islanding event occurs (i.e. the generator is connected to an island of load which is not connected to the bulk electric system) unless other arrangements have been made with AECC and its member cooperatives.
 - For generation facilities operated in parallel with Coop Facilities, the user will ensure that the user's protective devices do not reclose the generator into the Coop Facilities until after AECC's or its member cooperatives' protective devices or personnel have removed any problems from the Coop Facilities.
 - AECC will not be responsible for protection of the interconnecting customer's equipment and facility. The interconnecting customer is solely responsible for protecting their equipment in such a manner that faults, unbalances or other system disturbances on AECC's transmission system do not cause damage to the interconnecting party's facilities.
 - Synchronizing of interconnecting facilities is the responsibility of the interconnecting customer.

The following may also apply:

Entergy: PM3901 Rev 7, §5.8; LGIA Articles 9.7.3, 9.7.4, 9.7.5, 9.7.6;
SL0002 Latest Rev.

AEP: TP0001 Rev 0, §4.3.16, 4.4, 5.1.4.

- Metering & telecommunications [NERC FAC-001R2.1.6]
 - Unless otherwise agreed by the parties, AECC shall install the metering equipment at the interconnecting customer's facilities and shall own, operate, test and maintain such equipment. Metering equipment will include current transformers, potential transformers, revenue meter and accessories.
 - In addition to metering, the user will supply AECC and/or its member cooperatives with a status signal indicating when the generator is interconnected with AECC's or its member cooperatives' transmission system, whether or not the generator is currently generating (i.e. breaker status).
 - AECC, at its own discretion, shall install, own, operate and maintain a remote terminal unit. Data protocol requirements will be specified by AECC and supplied to the interconnecting customer.
 - Each individual party shall be responsible for installing and maintaining their own communication circuits.

The following may also apply:

Entergy: PM3901 Rev 7, §5.10, 5.11; SL0002 Latest Rev, §10.3, 10.5, 10.6.
 AEP: TP0001 Rev 0, §4.3.17, 5.16, 8.0.

- Grounding & safety issues [NERC FAC-001R2.1.7]
 - Grounding practices shall conform to applicable sections of the latest edition of the National Electric Code (NEC), National Electrical Safety Code (NESC), IEEE 80, Guide for Safety in AC Substation Grounding, IEEE 81, Guide for Measuring Earth Resistivity, IEEE Std. 142, Industrial and Commercial Power System Grounding (Green Book), and IEEE Std. 1100, Powering and Grounding of Sensitive Equipment (Emerald Book).
 - Interconnecting customer shall design the grounding system to protect personnel and equipment during faults. All substation equipment, fencing, buildings, cabinets and structures shall be connected to the ground grid.
 - Underground connections shall be exothermic type. AECC reserves the right to inspect these connections before backfilling has occurred.
 - AECC will make the final determination as to whether the AECC facilities are properly protected before an interconnecting party's facility is energized. The interconnecting customer is responsible for the adequate protections of their own equipment and for correcting such problems before the facilities are energized.
 - Overhead shield wires or masts shall be installed for protection against direct lightning strikes. The shield system shall be connected to the substation ground grid. The lightning protection design shall be in accordance with IEEE 998.

The following may also apply:

Entergy: PM3901 Rev 7, §2.0, 5.3, 5.7, 5.8; SF0201 Latest Rev; SL0002, Latest Rev.

AEP: TP0001 Rev 0, §4.3.9.

- Insulation & insulation coordination [NERC FAC-001R2.1.8]
 - Power system equipment is designed to withstand voltage stresses associated with expected operation. The following ratings shall apply to the interconnecting facilities equipment and accessories.

| Voltage Rating | Minimum Basic Impulse Level |
|----------------|-----------------------------|
| 69 kV | 350 kV |
| 115 kV | 550 kV |
| 138 kV | 650 kV |
| 161 kV | 750 kV |

The following may also apply:

Entergy: TA050300.

AEP: TP0001 Rev 0, §4.3.19, 5.1.8, 7.20.

- Voltage, Reactive Power, and power factor control [NERC FAC-001R2.1.9]
 - When not generating or for load interconnections, the user's facilities will maintain a 98% lagging power factor or better at the point of interconnection of its facilities with Coop Facilities during the summer months (June-September) and a 95% lagging power factor or better during all other months (October-May).
 - The interconnecting customer shall be responsible for supplying their own reactive power needs. Switched reactive resources shall be designed to not cause voltage transients on the system.

The following may also apply:

Entergy: PM3901 Rev 7, §5.7.8, 5.7.9; LGIA Article 5.10; SGIA; Voltage Schedules.

AEP: TP0001 Rev 0, §4.3.2.

- Power quality impacts [NERC FAC-001R2.1.10]
 - Interconnecting facilities will comply with the requirements of AECC's current Voltage Fluctuation and Harmonic Distortion Rider (VF-1) filed with the Arkansas Public Service Commission. This rider specifies the allowable voltage fluctuations and harmonic distortion allowed for interconnecting facilities.

The following may also apply:

Entergy: LGIA Article 9.7.6; SL1904 Latest Rev.

AEP: TP0001 Rev 0, §4.3.3, 5.1.3.

- Equipment ratings [NERC FAC-001R2.1.11]

- All power system equipment shall be designed for reliable operations rated for future load and system expansion in the 10-15 year time frame.
- Equipment ratings shall be in accordance with the latest ANSI, IEEE, NEMA and NERC requirements and be in accordance with AECC's methodology for determining facility ratings.
- Equipment which AECC determines unacceptable with regard to industry standards and sound utility practices shall not be installed.

The following may also apply:

Entergy: PM3901 Rev 7; SL0002, Latest Rev.

AEP: TP0001 Rev 0, §7.18.

- Synchronizing of facilities [NER FAC-001R2.1.12]
 - Generating facilities which will be connected to Coop Facilities after they are already generating will not connect to Coop Facilities unless the Coop Facilities and the generator have a slip frequency less than 0.048 Hz and a phase angle difference of less than 40 degrees.

The following may also apply:

Entergy: PM3901 Rev 7, §5.9; LGIA Article 9.5.

AEP: TP0001 Rev 0, §4.3.4.

- Maintenance coordination [NERC FAC-001R2.1.13]
 - AECC and the interconnecting customer shall maintain their own facilities and equipment using safe, sound, and reliable utility practices.
 - The interconnecting customer will coordinate all outages of its facilities with AECC **prior to them being taken out of service.**

The following may also apply:

Entergy: LGIA Article 10; SGIA; SL0002 Latest Rev.

AEP: TP0001 Rev 0, §4.5.

- Operational issues (abnormal frequency & voltages) [NERC FAC-001R2.1.14]
 - Interconnecting customers connecting to AECC's or its member cooperatives' transmission system within the area where Entergy acts as the Transmission Provider will not create a normally closed loop/path between two of AECC's or its member cooperatives' delivery points from Entergy.
 - The interconnecting customer shall install adequate protection or safeguards to prevent damage to AECC due to abnormal frequency and voltage excursions originating at the interconnected facility.

The interconnecting customer shall be required to participate in the automatic under frequency load shedding program.

The following may also apply:

Entergy: PM3901 Rev7, §5.7, 5.8.12, 5.8.14, 5.8.15, 5.11.

AEP: TP0001 Rev 0, §4.3.4.1, 5.1.5.

- Inspection requirements for existing or new facilities [NERC FAC-001R2.1.15]
 - AECC will have the right to inspect the interconnecting facilities **prior to them being put in service**. Also, after the interconnecting facilities have been put in service, AECC will have the right to inspect them upon reasonable notification to the interconnecting customer.
 - The interconnecting customer shall give advanced notice to AECC of any significant changes planned for the facility. AECC will have the right to inspect the interconnecting facilities once these significant changes have been made by the interconnecting customer.

The following may also apply:

Entergy: PM3901 Rev 7, §5.7.3, 5.7.7, 5.8.6, 5.8.9; SL0002 Latest Rev.

AEP: TP0001 Rev 0, §10.0.

- Communications & procedures during normal & emergency operating conditions. [NERC FAC-001R.2.1.16]
 - The interconnecting customer shall notify the AECC Wynne Transmission Operations Center of normal and emergency system operational events.
 - Normal events will include, but are not limited to, the following: System paralleling or splitting, scheduled and unscheduled outages, equipment clearances, etc.
 - Emergency events will include, but are not limited to, the following: System events that can jeopardize the safety and reliability of AECC’s transmission system unless immediate action is taken to prevent its occurrence.

The following may also apply:

Entergy: PM3901 Rev 7, §5.11.

AEP: TP0001 Rev 0, §8.5.

Note: Unless otherwise noted, requirements for AEP will be referenced from AEP’s Requirements for Connection of New Facilities or Changes to Existing Facilities Connected to the AEP Transmission System, TP-001 Rev.0.**Revision History**

| Version | Date | Reviewers | Revision Description |
|---------|-----------|-----------------|-----------------------|
| 0 | May 2007 | Ronnie Frizzell | Original |
| 1 | June 2009 | David McRae | Modified requirements |
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