

**Facility Connections Requirements
Of
Associated Electric Cooperative, Inc.**

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AECI Facilities Connection Requirements

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I. Purpose

To avoid adverse impacts on reliability, Associated Electric Cooperative Incorporated ("AECI") has established the following facility connection and performance requirements for interconnections to AECI's Bulk Transmission System.

II. Application

These facility connection requirements shall apply to new electric generating facilities, new transmission interconnection facilities, and end-user facilities that are planned for interconnection to the AECI Bulk Transmission System.

III. Definitions

- III.1 Facility – Equipment used for the interconnection of an electric generator(s), transmission interconnection, or end-use load site directly connected to the AECI Bulk Transmission System.
- III.2 AECI Bulk Transmission System – Any transmission line owned by AECI or by AECI's six member G&T cooperatives that is energized at a voltage greater than 100kV
- III.3 Interconnecting Party – a party, other than AECI or an AECI member G&T, desiring to interconnect to the AECI Bulk Transmission System for the purpose interconnecting an electric generator, transmission interconnection or end-use load.
- III.4 Point of Interconnection – A physical location where the Facility of the Interconnecting Party connects to to the AECI Bulk Transmission System.
- III.5 NERC – North American Electric Reliability Corporation or its successor organization.
- III.6 SERC - SERC Reliability Corporation or its successor organization.

IV. Agreements

- a. Prior to the in-service date of any Facility by an Interconnecting Party, an Interconnection and Operating Agreement ("IOA") must be executed by both AECI and the Interconnecting Party. The IOA shall address the requirements in this document and ensure that there is no misunderstanding regarding the authority or the responsibility of the parties involved. These connection requirements, outlined herein, shall apply to interconnection facilities installed by AECI, or AECI's G&T member, as well as to the Interconnecting Party's Facilities.

V. Facility Connection Requirements

- a. These general requirements are applicable to a proposed Facility connected to the AECI Bulk Transmission System. These requirements are consistent with the content and application used within our Organization.

V.1 Criteria for Studies of New Facilities

- a. All facilities in service: With all system facilities in service, no voltage shall be less than 95% of nominal at load-serving stations, nor shall any transmission system element be loaded to more than 100% of its top rating.
- b. Single contingency outages: With any single transmission line, transformer, generator, or reactive device outage, no voltage shall be less than 88% of nominal at load-serving stations, nor shall any transmission system element be loaded to more than 100% of its top rating.
- c. During the initial screening an interconnection is considered to have a negative impact on the AECI system if it causes any criteria violations and has a 5% or greater increase of flow on a facility based upon its rating.

All AECI facilities 69 kV and greater must meet the above criteria. In addition, network stability must be maintained and all native load and firm transmission commitments must be met. Reasonable operating guides that do not further violate these criteria may be considered for alleviation of such contingencies provided that the operating guide is agreed upon by AECI, and if applicable, the interconnected utility.

V.2 Coordinated Joint Studies of New Facilities

- a. For any proposed Facility connection to the AECI Bulk Transmission System, AECI requires that sufficient data be provided from the Interconnecting Party in order that system studies can assess the impact of the Facility on the AECI Bulk Transmission System and adjacent transmission systems. At a minimum, load flow and short circuit studies will be performed using the data provided by the Interconnecting Party. Stability studies shall be performed, if needed.
- b. If the proposed Facility is a new transmission interconnection, AECI and the Interconnecting Party will assess and agree upon any system upgrades that are required.
- c. The proposed Facility shall not negatively impact AECI's ability to utilize existing generating resources, serve its existing network and native load, or AECI's ability to import and export power and energy.
- d. Once studies are performed, AECI shall work with the Interconnecting Party to identify specific transmission additions and provide a non-binding cost estimate of the transmission additions or upgrades identified in the studies.

V.3 Notification of New or Modified Facilities to Others

- a. Once an IOA has been executed addressing a proposed Facility, AECI shall provide updated information to regional models of the transmission system regarding proposed Facilities on the AECI Bulk Transmission System. In addition, the IOA shall include requirements that the Interconnecting Party contact AECI's Transmission Planning department with any changes in MW capacity, energy output or usage, or facility rating changes that impact the operation of the AECI Bulk Transmission System. AECI shall provide the updated information to regional models as soon as feasible and to operating

models for use in the Interchange Distribution Calculator (IDC), Available Flowgate Capacity (AFC) calculations, etc. The AECI Transmission Planning Department shall be responsible for notifying neighboring utilities and reliability coordinators with data changes. If changes involve Automatic Generation Control (AGC) settings that affect the AECI control area, then the information will be provided to AECI Energy Management System and Operations personnel.

V.4 Voltage Level, MW and Mvar Capacity at the Point of Interconnection

- a. The interconnecting primary voltage level shall be determined by AECI. This determination will be based on the MW and Mvar capacity of the Facility and the capability of the surrounding AECI Bulk Transmission System. Conversion of existing circuits to a higher voltage level may be required as determined by studies performed in V.1 above.

V.5 Breaker Duty and Surge Protection

- a. AECI shall review and approve surge protection specifications of Facility equipment to ensure a consistent design with the AECI Bulk Transmission System.

V.6 System Protection Requirements for Electric Generators & End Users

- a. The Interconnecting Party is responsible for providing protection devices that will protect its equipment against faults and disturbances on the AECI Bulk Transmission System and on the Interconnecting Party's system. The Interconnecting Party shall use AECI's design criteria for protection of any part of the AECI Bulk Transmission System. AECI's design criteria states that "all faults on the AECI Bulk Transmission System must be seen by two relays on separate battery systems."
- b. AECI will have no responsibility for inspection but reserves the right to observe the Interconnecting Party's tests and/or inspection of any of the Facilities protective equipment that is essential to the interconnection, including relays, circuit breakers, protective devices and related equipment. Inspection may include simulated test tripping of the Facilities' interconnection breakers by the protective relays.
- c. Settings of all protective devices (current transformers, potential transformers, relays, reclosers, fuses, etc.) on the AECI Bulk Transmission System will be specified by AECI.
- d. Settings of interconnection protective devices on the Facilities' system will be specified by the Interconnecting Party, but will be checked, coordinated with, and reviewed by AECI before application and subsequent modification.
- e. The Interconnecting Party shall install underfrequency protection on its equipment. If applicable, AECI shall require that the Interconnecting Party shed load on underfrequency conditions as directed by SERC and NERC Reliability Standards in proportion to the Interconnecting Party's load on the system.
- e. The Facility owner shall install, according to SERC and NERC Reliability Standards, undervoltage load shedding (UVLS) relays. AECI shall review and approve the scheme and settings for UVLS.

- f. The Interconnecting Party shall have full responsibility for the routine maintenance of its equipment and protective devices. Complete maintenance records of the protective devices essential to the interconnection must be maintained by the Interconnecting Party and be available for AECI's review.
- g. The Interconnecting Party shall provide information in order to comply with applicable NERC and SERC Reliability Standards relating to the implementation and maintenance of the protective relaying system.
- h. Any protective device changes on AECI's Bulk Transmission System that may be required by interconnection with an Interconnecting Party's electric generator(s) shall be made by AECI at the Interconnecting Party's expense. Any cost incurred by AECI and required for additions or modifications to existing Interconnecting Party's generation facilities shall also be borne by the Interconnecting Party.
- i. The Interconnecting Party with an electric generator will provide a circuit breaker(s), as specified by the applicable IEEE Standards, between its generator(s) and the AECI Bulk Transmission System. This breaker(s) must be capable of interrupting the maximum fault current available from either the Interconnecting Party's generator(s) or the AECI Bulk Transmission System, whichever is greater, and must be capable of withstanding twice the voltage normally applied. The values for fault currents available from the AECI Bulk Transmission System will be supplied by AECI, provided the Interconnecting Party has submitted sufficient data concerning its proposed system.
- j. A visible disconnecting device with load interrupting capability shall be located between the Facility and the AECI Bulk Transmission System. The Facility's disconnecting device shall be acceptable to AECI for this purpose or AECI will install a disconnecting device at the Interconnecting Party's expense. AECI reserves the right to open the disconnecting device with or without prior notice to the Facility for any of the following reasons:
 - System emergency
 - Interference of the Facility's equipment with service to AECI member load or with operation of the AECI Bulk Transmission System
 - Existence of a hazardous condition, lack of scheduled maintenance or lack of maintenance records, as revealed by inspection of the Facility's protective devices
- k. When a step-up or step-down transformer is used, the winding connection to be used at the primary voltage interconnecting point will be specified by AECI. The requirement for a wye grounded primary connection will necessitate the use of a three-phase interrupting device (breaker) at the primary voltage level. Depending on the system parameters, a current limiting reactor may be required in the neutral of the wye winding.
- l. Protective and associated devices may be required at the primary voltage level to detect ground faults that occur on the AECI Bulk Transmission System. These devices will operate to isolate the Facility from the AECI Bulk Transmission System and eliminate any ground current contribution from the Interconnecting Party's generator.
- m. All shunt-tripped short circuit interrupting devices must be equipped with reliable power sources. A battery with associated charging facilities is considered a reliable source.

- n. Inverters, when used by the Interconnecting Party, shall be designed so that a utility system interruption will result in their disconnection from the AECI Bulk Transmission System. Harmonics generated by the DC-AC generator-inverter combination must not cause any reduction in the quality of service provided to other customers or interference with communication circuits.
- o. The Interconnecting Party shall be solely responsible for provisions to disconnect its generation automatically when a disturbance on the AECI Bulk Transmission System results in the Interconnecting Party's generation being isolated from AECI Bulk Transmission System. In the event the Interconnecting Party fails to provide such, the Interconnecting Party shall be liable for damage resulting from an out-of-step condition and liable for causing a hazardous condition on the AECI Bulk Transmission System.

V.6.1 System Protection Requirements for Transmission Interconnections

- a. The protective relaying responsibilities of AECI and the Interconnecting Party of a transmission interconnection shall be addressed in the IOA between the two parties or if applicable an amendment to an existing IOA. Items to be addressed include the responsibility of maintenance of relaying equipment according to Good Utility Practice, the coordination of relay settings, the testing of relaying and communications equipment and NERC/SERC reliability reporting.

V.7 Metering and Telecommunications

- a. All Facilities connected to the AECI Bulk Transmission System shall provide metering capable of reporting instantaneous and hourly MW and MVAR values at the Point of Interconnection. If the Point of Interconnection is to be operated as an Interchange Tie, a telecommunication channel shall be provided from the Facility to the AECI System Operations Center (SOC). AECI, at their sole discretion, may accept the Tie interchange value at a remote location rather than the SOC.
- b. The Interconnecting Party shall make available to AECI on at least a monthly basis, hourly meter readings on the flow of real and reactive power over the Point of Interconnection. The Interconnecting Party shall supply the readings in an electronic format.
- c. If the proposed Facility connection is with another transmission owner, the IA shall address the responsibilities of each party as related to the provisions of metering data and telecommunications facilities.

V.8 Grounding and Safety Issues

- a. For all Facilities connected to the AECI Bulk Transmission System, AECI shall review and approve the grounding plan to ensure that a safe and reliable grounding plan is designed.
- b. For safe operation during switching, AECI shall assign device numbers to sectionalizing equipment connected to the AECI Bulk Transmission System. The Interconnecting Party shall coordinate with AECI in developing switching procedures for operation of the Point of Interconnection.

- c. AECI may require a visible disconnect at the Point of Interconnection.

V.9 Insulation and Insulation Coordination

- a. The Interconnecting Party shall supply Basic Impulse Level design data to AECI for review and approval. Equipment includes but is not limited to Generator Step-Up (“GSU”) transformers, start-up transformers, and auxiliary transformers. The Interconnecting Party shall submit the design data for transmission lines connecting to the AECI Bulk Transmission System to AECI for review and approval. AECI may require that the low voltage equipment be protected from animal contact by wrapping bus work and other related equipment.
- b. If the proposed Facility connection is with another transmission owner, the parties shall work together to coordinate insulation requirements and should be addressed in the IOA.

V.10 Voltages, Reactive Power and Power Factor Control

- a. An Interconnecting Party with an electric generator shall perform the following: 1) follow voltage or reactive power schedules as directed by AECI, 2) maintain units in AVR as required by NERC Reliability Standards, and 3) provide reactive power as to not burden the AECI Bulk Transmission System.
- b. An Interconnecting Party with end-use load shall be required to operate their system with an acceptable power factor. Typically, AECI requires at least 97% power factor on end-use loads connected to the AECI Bulk Transmission System. If the requirement is not met, AECI reserves the right to penalize or ultimately curtail service to end-use loads not meeting the requirements of the IOA or not operating to Good Utility Practice.
- c. All transmission interconnections shall require that both parties supply their reactive load to their system and not burden the other party.

V.11 Power Quality Impacts

- a. Inverters, when used by the Interconnecting Party, shall be designed so that a utility system interruption will result in their disconnection from the AECI Bulk Transmission System. Harmonics generated by DC-AC generator-inverter combination must not cause any reduction in the quality of service provided to other customers or interference with communications circuits.
- b. AECI shall review and approve any switched devices operated by the Interconnecting Party that could result in unacceptable voltage fluctuation or power quality concerns on the AECI Bulk Transmission System.

V.12 Equipment Ratings

- a. AECI shall review and approve all ratings of equipment connected to the AECI Bulk Transmission System. This includes, but is not limited to, breakers, instrument transformers, conductors, bus work, and switches. AECI’s Rating Criteria shall be used to

determine ratings on equipment connected directly to the AECI Bulk Transmission System. In the event the Facility is an interconnection with another transmission owner, the two parties will agree on the ratings. If agreement cannot be reached, the most limiting ratings will be assigned.

V.13 Synchronization of Facilities

- a. The Interconnecting Party shall be solely responsible for synchronizing and properly connecting and disconnecting its electrical system relative to parallel operation with the AECI Bulk Transmission System. If generation is connected, the Interconnecting Party shall supply an auto or semiautomatic synchronizing scheme to prevent the closing of its circuit breaker when the two electrical systems are out of synchronism. This scheme will inherently prevent the Interconnecting Party from closing its circuit breaker when AECI's circuit is de-energized. The Interconnecting Party furnished synchronizing scheme shall consist of the following (or a functionally equivalent scheme acceptable to AECI) as a minimum:
- Synchronizing Switch - To supervise the circuit breaker closing circuit and activate the synchroscope and the synchronizing relay as described below. This switch must be closed (ON) before the circuit breaker can be closed.
 - Synchroscope - This meter provides a visual indication of the relative synchronism between the two electrical systems. The meter is activated by the synchronizing switch and is only operational prior to the actual closing of the circuit breaker.
 - Synchronizing Relay - This relay supervises the circuit breaker closing circuit and allows manual closing only when the two electrical systems are within a specified degree of perfect synchronism

V.14 Maintenance Coordination

- a. The Interconnecting Party shall provide maintenance schedules to AECI for the purpose of reliability coordination within AECI and neighboring systems. Conversely, AECI shall inform the Interconnecting Party of any maintenance that may affect the operation of the Facility. AECI and the Interconnecting Party shall work together to establish mutually agreeable maintenance schedules.
- b. Maintenance schedules shall be supplied each month with weekly updates provided as necessary. Both parties shall attempt to provide as much notice as possible on planned maintenance. AECI's minimum requirement for outage notification is seven days.

V.15 Operational Issues

- a. Abnormal voltage and frequency conditions can occur on the interconnected system. As directed in section V.5, the Interconnecting Party shall have installed adequate relay protection for voltage and frequency excursions. However, AECI System Operators may be aware of voltage and frequency events where the Interconnecting Party is required to act to help alleviate the problem. At all times, the Interconnecting Party is required to follow the instructions of the AECI System Operator. The Interconnecting Party shall provide AECI with a 7/24 contact for system operations. The operators of the Facility shall have the authority to take necessary action at the direction of the AECI System Operator.

V.16 Inspection Requirements for Existing or New Facilities

- a. AECI shall have the right to inspect any equipment that is in line or in contact with AECI's Bulk Transmission System. The Interconnecting Party shall reimburse AECI for the cost of inspection. The Interconnecting Party shall furnish final construction drawings to AECI.

V.17 Communications and Procedures During Normal and Emergency Conditions

- a. Communications between AECI System Operator and the Interconnecting Party shall be professional at all times with personnel identifying themselves and concisely stating the operational issue.
- b. During normal operations, operators for both parties shall attempt to state the operating issue and can request that a particular action be taken. The Interconnecting Party can express their reasons for disagreeing with a direction from AECI. The AECI operator will take their objection under advisement and make operational decisions taking into account any additional information that may have been supplied by the operators of the Facility. If agreement cannot be reached, AECI's Supervisor of System operations may contact the Facility supervisor for further discussion and agreement. If agreement cannot be reached, the Facility shall follow the instruction of AECI system Operations.
- c. If the operational issue is an emergency, the AECI dispatcher will concisely describe the emergency and that immediate action be taken by the Facility operator. The Facility operator shall perform the operation immediately.

VI. Document Communication and Maintenance

- a. AECI shall maintain and update these requirements as necessary. The requirements will be provided to transmission users, SERC, and NERC within 5 business days upon request.