

# Facility Connection Requirements

## Preface

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This document describes City Utilities of Springfield, Missouri (CU) technical requirements for planned and/or operated interconnections of generation, transmission and/or end-user load facilities to CU. Additional requirements may be necessary and will be determined on a case by case basis. The CU Facility Connection Requirements will be made available upon request.

## 1.0 General Facility Connection Requirements

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Facility Connection with City Utilities of Springfield, Missouri electric transmission system may be permitted provided such connection complies with the procedures and requirements set forth herein. All Transmission, Generation, and load connected to the CU system will be within the Southwest Power Pool (SPP) Balancing Authority Area.

### 1.1 Definitions:

- 1.1.1 Transmission Owner:** Transmission Owner shall mean City Utilities of Springfield, Missouri (CU).
- 1.1.2 Transmission Provider:** CU's Transmission Provider is the Southwest Power Pool (SPP). This definition does not imply the taking of transmission service under any Open Access Transmission Tariff (OATT).
- 1.1.3 Transmission System:** A transmission system is defined as those electrical system facilities that do not satisfy the Federal Energy Regulatory Commission ("FERC") seven-factor test for determining distribution facilities and are not generator step-up transformers or lead lines and associated equipment.
- 1.1.4 Requesting Party:** Requesting Party shall mean a person or entity responsible for ownership, operation and maintenance of (generation, transmission or end-user) facilities that requests a connection to CU's Transmission System. Unless stated otherwise, the Requesting Party will pay for the entire cost of the interconnection including all costs to modify or upgrade CU's facilities. Requesting Party shall be responsible to adhere to all appropriate laws and regulations, including, but not limited to, NERC standards and the requirements of any regional transmission organization, independent system operator or other Transmission Provider (so long as TO's requirements are at least equivalent to those of an RTO or ISO.)
- 1.1.5 Facility Connection:** Facility Connection shall mean the point where CU's and the Requesting Party's facilities physically meet.
- 1.1.6 Generating Source:** A Generating Source is defined to exist when ANY of the following conditions are met:



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| <b>Business Unit:</b> | Transmission Planning            |
| <b>Policy Title:</b>  | Facility Connection Requirements |
| <b>NERC Standard:</b> | FAC-001                          |
| <b>Policy Number:</b> | 0051                             |
| <b>Version:</b>       | 9                                |
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| <b>Distribution:</b>  | Public                           |

- A. Requesting Party's facilities can produce sustained (in excess of one (1) second duration) watt or var flow into CU's facilities at the closed Facility Connection.
- B. Requesting Party's facilities can energize CU's facilities across the Facility Connection at sustained levels of fifty-one (51) volts or more during times when the Transmission Provider's source is de-energized.
- C. Requesting Party's facilities can energize the Facility Connection with sustained voltage magnitude and frequency quantities that differ from CU's values.
- D. Requesting Party's facilities can contribute fault-current to CU's facilities at the Facility Connection.
- E. Distributed Energy Resources (DER) and Inverter Based Resources shall be considered a Generating Source and shall meet the same requirements for a Generating Source at each point of Facility Connection.

**1.2** All applicable Local, State, and Federal laws and regulations shall govern connection of Requesting Party's facilities with Transmission System.

**1.2.1** In addition, Requesting Party's facilities shall be installed in accordance with all provisions set forth in:

- National Electrical Safety Code (ANSIC2) (Or any successor document or entity)
- National Electrical Code (NFPA70) (Or any successor document or entity)
- North American Electric Reliability Corporation (NERC) (Or any successor document or entity)
- American National Standards Institute (ANSI) (Or any successor document or entity)
- Institute of Electrical and Electronics Engineers (IEEE); or other Regulatory or Governing Body having jurisdiction. (Or any successor document or entity)

Requesting Party must comply with the most recent version of these documents.

**1.2.2** Any applicable law, regulation, rule, order, provision, guide, or code of an organization, council, institute, regulatory, or governing body having jurisdiction over such matters shall further govern connection of Requesting Party's facilities with Transmission System.

**1.3** For any new proposed facility connection (or material modification to an existing facility connection) to City Utilities' transmission system, coordinated joint studies, by CU and the Southwest Power Pool, of the new facilities need to be performed to assess the impact of the interconnect on the transmission system in accordance with the



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applicable sections of the SPP OATT, e.g. Attachment's O and V. The Requesting Party shall coordinate the exchange of modeling data with CU and the Transmission Provider as necessary. The Requesting Party shall provide all detailed engineering design studies, model data, and installation of facilities required for connection with Transmission System.

- 1.4** Requesting Party shall be responsible for compliance with all applications, permits, licenses, fees, rules, regulations, standards, agreements, ordinances, inspections, and other requirements imposed by CU, Transmission Provider and/or any regulatory or governmental body having jurisdiction. There is no obligation on the part of CU to connect, or to remain connected whenever Requesting Party's facilities are out of compliance. In addition, Requesting Party shall be responsible for modifying CU's facilities in accordance with all applicable laws, regulations, rules, orders, provisions, guides, or codes of an organization, council, institute, regulatory or governing body having jurisdiction over such matters.
- 1.5** Because of risks and potential hazards inherent with operating Requesting Party's facilities connected with CU's facilities, overall safety for life, quality of service and property is paramount. CU shall take appropriate action to mitigate a dangerous condition caused by a Requesting Party's facilities
- 1.6** Requesting Party shall provide CU a minimum, of eighteen (18) months written notice, unless otherwise agreed to by CU, of its intent to connect facilities to the Transmission System. Notice of intent for the point of connection shall include, but not be limited to, the following information:
  - 1.6.1** Location
  - 1.6.2** Connected MW, MVAR, MVA and Voltage Level
  - 1.6.3** Average and Peak Watt Demand
  - 1.6.4** Reactive Power Requirements
  - 1.6.5** Connected Generation & Type: (synchronous, induction, converter)
  - 1.6.6** Large Motors including Type (synchronous, induction, VFD)
  - 1.6.7** Fault Current Limits
  - 1.6.8** Power Quality Requirements
  - 1.6.9** Reliability Requirements
  - 1.6.10** Equipment Ratings and Insulation Levels (BIL)



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**Version:** 9  
**Date:** 12/10/2018  
**Distribution:** Public

Requests to install Facility Connection shall be submitted to:

City Utilities of Springfield, Missouri  
Associate General Manager – Electric Supply  
P.O. Box 551  
Springfield, MO 65801-0551

- 1.7 Within ninety (90) days of receiving a written request to connect facilities, but not less than one hundred twenty (120) days prior to facility connection, the coordinated joint studies will be performed by CU and SPP and CU shall submit to Requesting Party preliminary general equipment requirements such as breaker(s), switches, supervisory control and data acquisition (SCADA), and existing CU facility protection scheme, required for Requesting Party to proceed with Facility Connection design. In addition, CU shall notify Requesting Party of costs to evaluate the proposed Facility Connection.
- 1.8 Within ninety (90) days of receipt of a complete copy of Requesting Party’s detailed engineering studies, design specifications, proposed protective relaying schemes, and payment of costs for evaluation, CU shall review, perform analysis, and notify Requesting Party of approval and/or conditions for acceptance. Should CU be unable to evaluate Requesting Party’s request to connect as submitted, CU shall provide Requesting Party a written explanation of information required to complete the evaluation.
- 1.9 Only written notice shall constitute acceptance by CU. Written approval by Southwest Power Pool or other Transmission Provider or Independent System Operator does not waive any requirements pertaining to Requesting Party’s installation that may be governed directly by or other jurisdictional bodies. Southwest Power Pool’s as well as other Transmission Provider or Independent System Operator’s specifications and requirements are designed towards protecting the safety of life, quality of service and property, and do not assume nor ensure proper protection of Requesting Party’s facilities equipment during electrical faults.
- 1.10 When CU is required to incur expenses necessary to make extensions or improvements of its lines or additions to its disconnecting devices, transformers, meters, breakers, relays, controls, data systems, metering, and telecommunications or to make any other equipment modifications relating to its circuits, substations, or apparatus necessary to connect Requesting Party’s facilities, and such expenses made are attributable to this application, then all costs incurred by CU for Facility Connection shall be borne by Requesting Party as set forth in the Connection Agreement. Such costs are due and payable prior to CU commencing construction, and are non-refundable in whole or in part at any time. The CU shall retain ownership of all equipment provided by the Requesting Party and installed on CU’s premises, unless stated otherwise in the Connection Agreement.
- 1.11 Requesting Party, CU, and Transmission Provider shall execute coordinated studies and appropriate agreements for connected service prior to installation of any

equipment in accordance with Transmission Provider's FERC-approved OATT Transmission Provider's time frame to complete necessary studies shall govern the Facility Connection schedule.

**1.12** CU may require Requesting Party's facility design to include an appropriate automatic disconnecting device to be controlled by any or all of the following: overcurrent relays, impedance relays, current differential relays, automatic synchronizing relays, out-of-step relays, voltage relays, frequency relays, ground fault detection relays, breaker failure relays, or any other automatic relaying equipment, including associated communications and/or SCADA equipment, necessary to ensure proper protection and safety of CU employees, customers, equipment, and overall system integrity. CU reserves the right to review, inspect, and approve Requesting Party's design and shall not give approval to connect until any concerns relating to Requesting Party's design have been remedied. Refer to Appendix A, "Relay Standard for Connected Generating Facilities," and Appendix B, "Relay Standard for Connected Load Facilities."

**1.13** The Requesting Party shall procure, install, and maintain all metering equipment, including associated current and voltage transformers, required to measure energy exchanged between Requesting Party and CU across the Facility Connection. Meter specifications shall comply with CU's and Transmission Provider's requirements. CU reserves the right to locate its metering at a place other than the Facility Connection and adjust for losses as appropriate.

## **2.0 Transmission System Connection Requirements**

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**2.1** 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 step-up transformers or lead lines and associated equipment.

### **2.1.1 Transmission Facilities - General Requirements**

- A. Any electrical structure or equipment utilized for high-voltage service shall be connected to an earth-ground grid that measures no more than 0.6 ohms resistance to earth. Such value shall be measured with equipment and techniques and shall be certified by a measuring contractor qualified for this service approved by CU. The connectors and components of the grounding grid shall be adequate for the anticipated short-circuit current magnitude and duration.
- B. Supervisory remote control and electrical metering shall be provided using devices and communications paths and protocols specified by CU. Such equipment shall be proven operational before electrical operation begins.



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- C. Maintenance at the Facility Connection shall be coordinated with CU. Each respective Facility Owner shall maintain its equipment at its expense.

### **2.1.2 Transmission Facilities – up to 161 kV Requirements**

- A. Multiple remotely controllable line-sectionalizing switches and/or circuit breakers with protective relays may be required at Facility Connection.
- B. Substation design shall typically be ring-bus or breaker-and-a-half configuration.
- C. Structures at Facility Connection may be required to be of steel construction.
- D. Transformers capable of serving load greater than 14.0 MVA shall be controlled by a circuit switcher or circuit breaker with appropriate protective relaying.
- E. Sectionalizing devices may require load breaking and/or fault interrupting capability with sufficient short circuit duty and surge protection capabilities.
- F. Protective relay schemes of Requesting Party shall be integrated and coordinated to operate with protective relay schemes and communication protocols on CU facilities.
- G. Protective relaying shall include both primary and backup schemes, including associated equipment, wiring, time synchronization, fault recording, and communications. At least one of the protection schemes shall be high-speed communication (piloted) based. The protection schemes should address backup relaying and breaker failure scenarios.
- H. DC system control power for 161 kV relay schemes shall be supplied from redundant DC supply systems, i.e. separately fused DC circuits.
- I. If the Requesting Party's proposed connection is at a CU Substation where a power plant is located, automatic line reclosing may only occur for Requesting Party hot-line and CU hot-bus conditions.

### **2.1.3 Transmission Facilities – Greater than 161 kV**

- A. All requirements for lower-voltage transmission system connections shall apply. In addition, the following requirements shall apply:
- B. Substation design shall be ring-bus or breaker-and-a-half configuration.
- C. Structures at Facility Connection may be required to be of steel construction.
- D. Control power shall be supplied from redundant DC supply systems, i.e. separately fused DC circuits.

- E. Protective relaying shall include dual primary schemes. At least one of the schemes shall be high-speed communication based. The protection schemes shall address backup relaying and breaker failure scenarios.

## **3.0 Generating Source Facility Connection Requirements**

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### **3.1 General Requirements**

- 3.1.1** Generating Sources shall be three (3) phase to qualify for Facility Connection with Transmission System.
- 3.1.2** Generating Sources shall not close or reclose automatically onto a de-energized CU Facility Connection.
- 3.1.3** Generating Sources shall not supply sustained fault current to CU's facilities.
- 3.1.4** Disconnecting equipment shall provide a visible break between Requesting Party and CU's facilities.
- 3.1.5** Requesting Party shall design the generating facility to maintain a composite power delivery at continuous rated power output at the Point of Interconnection at a power factor between 0.95 leading to 0.95 lagging.
- 3.1.6** Supervisory Control and Data Acquisition (SCADA) is required by CU to connect Generating Source to Transmission Provider facilities.
- 3.1.7** Generating Sources that participate in the SPP market or MISO market shall install metering and telecommunications equipment compliant with the SPP or MISO market protocols, whichever is appropriate.
- 3.1.8** Generating Sources requesting Wholesale Service shall comply with Transmission Provider's OATT.
- 3.1.9** Connection to the Transmission System shall be at 60 Hz alternating current.
- 3.1.10** Generating Source shall be connected using a Grounded WYE-DELTA Generator Step Up transformer and shall be connected Grounded-WYE to CU's facilities.

### **3.2 Generating Source Types**

#### **3.2.1 Synchronous Generating Sources**

Synchronous Generating Sources shall utilize three-phase circuit breakers, which meet or exceed the following requirements:

- A. Rated for 2.0 per unit voltage across open contacts.
- B. Interrupt maximum available fault currents, including acceptable margins for future system changes, between Requesting Party's Generating Source and CU's facilities.

- C. Open for frequency and voltage deviations specified by Transmission Provider.
- D. Utilize synchronism check within +/- 10 degrees (or degrees as per CU's/Transmission Provider's planning study criteria dictates and joint acceptance) and +/- 5 percent of nominal voltage on each side of the breaker prior to closing the breaker between CU's and Requesting Party's facilities.
- E. Provide ground fault detection and tripping for breaker anytime an ungrounded circuit configuration exists as the result of opening CU's source to the Facility Connection.
- F. Continuously monitor breaker control power source. Alarm for loss of such power.

### **3.2.2 Induction Generating Sources**

Induction Generating Sources shall utilize three-phase circuit breakers, which meet or exceed the following requirements:

- A. Transmission Provider shall specify frequency and voltage deviations to Requesting Party for which circuit breaker shall open.
- B. Breaker control power source shall be continuously monitored. Alarm for loss of such power.

### **3.2.3 Converter Generating Sources**

Converter Generating Sources shall meet the following requirement:

- A. Converter Generating Sources shall cease operation for frequency and voltage deviations specified by the Transmission Provider.

## **3.3 Generating Source Facility Connections**

**3.3.1** Generating Sources shall be operated and maintained under the direction of the Transmission Provider.

**3.3.2** Generating Sources shall operate with excitation systems in automatic voltage-control mode.

**3.3.3** Generating Sources shall maintain reactive power output and associated margin, as required by CU Power System Operators within the demonstrated reactive capability of the unit.

**3.3.4** In addition to the protection described in 1.12, Generating Sources shall have reverse power, loss of field, differential generator current, differential transformer current, negative sequence current, volts per hertz, and inadvertent energization of the generator protection systems.

**3.3.5** Additionally, compliance with all NERC standards is required at all times.



**3.3.6** Generation Source should remain reliable for all BES operating conditions, including clearing of transmission line faults.

## **4.0 Commissioning of the Facility Connection**

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- 4.1** Requesting Party is responsible for commissioning of connection facilities. CU reserves the right to observe Requesting Party's commission and de-commissioning documentation.
- 4.2** CU may specify, measure and document the harmonics present at the Facility Connection before and after such connection is made. Requesting Party is responsible to ensure its system harmonics remain within ranges accepted by electric utility industry power quality standards, i.e. IEEE (or any successor entity).
- 4.3** CU reserves the right, but does not assume the duty, to inspect, test, or check Requesting Party's equipment in any way deemed appropriate to confirm operation and verify system protection characteristics. CU does not assume any responsibility in connection with such Requesting Party's equipment or the inspection thereof.
- 4.4** Metering equipment shall be verified by CU or its designated agent.
- 4.5** Only after all required inspection or testing is complete shall Facility Connection be synchronized to CU's facilities.

## **5.0 Operating Requirements:**

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- 5.1** Requesting Party agrees to respond to Transmission Provider's and CU's requests during abnormal conditions. The Requesting Party's facilities shall not cause unacceptable frequency and voltage fluctuations, power quality concerns, or other reliability problems on the electric transmission system.
- 5.2** Requesting Party shall ensure competent personnel are available to operate, maintain, inspect/monitor, and repair connected generating equipment at all times when such equipment operates in parallel with CU's facilities. Normal and emergency operations shall be communicated and coordinated with CU's power system control center. The Facility shall follow the instructions of CU Power System Operators at all times.
- 5.3** CU may require connected generating sources to have both normal and emergency paths for supervisory control, metering, or voice communications systems.
- 5.4** The Transmission Provider and CU require coordination with the regional underfrequency load shedding requirements/standards. Wholesale service providers shall be required to provide the Transmission Provider and CU with a documented manual load shed plan.
- 5.5** Requesting Party shall provide all available operating data upon request.



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- 5.6** Requesting Party shall adhere to Transmission Provider and NERC operation and reporting requirements standards. Requesting Party shall provide CU all operational reports and system event data that aid CU in operation and maintenance of the transmission system.
- 5.7** Requesting Party shall provide Transmission Operator the facility connection as-built documentation, including but not limited to: modeling information, equipment ratings, commissioning data, drawings (one-lines, three lines, AC and DC schematics, layouts, wiring, etc.), protection schemes including associated relay settings and logic diagrams, communications one-line, and any other requested data. As Requesting Party’s facilities change and impact CU, Requesting Party will document changes and provide the modifications (expressing updated information) to CU.
- 5.8** CU will update its records (which may include Requesting Party information) for the facilities at the connection, and may provide this information to third parties, when required.

## APPENDIX A

### Relay Standards for Connected Generating Facilities

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#### **A1.0 NERC Planning Standards, Section I.C.:**

All facilities involved in the generation, transmission and use of electricity must be properly connected to the interconnected transmission systems to avoid degrading the reliability of the electric systems to which they are connected.

#### **A2.0 Requirements for generating facilities:**

**A2.1** Requesting Party's facility design shall include an appropriate automatic disconnecting device to be controlled by any or all of the following: overcurrent relays, impedance relays, current differential relays, automatic synchronizing relays, out-of-step relays, voltage relays, frequency relays, ground fault detection relays, breaker failure relays, or any other automatic relaying equipment, including communications and/or SCADA equipment, necessary to ensure proper protection and safety of CU employees, customers, equipment, and overall system integrity. Open or closed status of disconnection device shall be provided via SCADA to Transmission Operator.

**A2.2** Protective relay schemes of Requesting Party shall be integrated and coordinated to operate with protective relay schemes of CU's facilities. Generating Sources shall:

**A2.2.1** not supply sustained fault current to CU facilities.

**Note:** Sustained shall generally mean in excess of one (1) second duration. However, under certain backup relaying conditions and with mutual consent of CU, Requesting Party's Generating Source may need to coordinate protection schemes and ride through fault events that will be cleared with backup protection, such as breaker failure, zone 2 or zone 3, or ground time over-current faults.

**A2.2.2** open for abnormal frequency and voltage deviations specified by CU and/or Transmission Provider.

**A2.2.3** utilize synchronism check not to exceed +/- 10 degrees and voltage limits of +/- 5 percent of nominal on each side of the disconnecting device prior to connecting Requesting Party's and CU's facilities. Based upon planning study results, the +/- 10 degrees may be modified (to not greater than 40 degrees) by CU and Requesting Party mutual acceptance of an alternate synchronism check angle.

**A2.2.4** provide ground fault detection and tripping for disconnecting device whenever an ungrounded circuit configuration exists as the result of opening the Transmission Provider's source to the Facility Connection.

**A2.2.5** continuously monitor disconnecting device control-power source.

**A2.2.6** not reclose automatically.

**A2.2.7** accept transferred-tripping initiated from CU facilities

**A2.2.8** be capable of transferring data to and from CU's SCADA system. Requesting Party may also be required to transfer SCADA data to a third party (regional control area entity) to be named by the CU.

### **A3.0 Outline of generating facility protective relay features:**

**A3.1** Protective relay features shall include:

**A3.1.1** alternate modes of operation for generating and non-generating conditions. Voltage, frequency, synchronism and backfeed requirements will differ between modes.

**A3.1.2** alternate modes of operation for generating and non-generating conditions. Voltage, frequency, synchronism and backfeed requirements will differ between modes. Other considerations include:

**A3.1.2.a** generation operational ride-through or tripping, as appropriate, for coordinating with all faults on CU's source while in generating mode.

**A3.1.2.b** tripping generator for all uncleared faults on CU's source while in generating mode. This protects CU's equipment from continued inadvertent energization and non-synchronous reclosure, and other CU customers from unpredictable electrical quality.

**A3.1.3** acceptance of direct-trip signal from a CU source while in generating mode.

**A3.1.4** closure of the interconnecting device through direct or indirect supervision of the protective relay for all modes of operation. This assures that the interconnection will be protected by a viable relay before closure.

**A3.1.5** closure of the interconnecting device through permissive synchronism-checking supervision of the protective relay. Hot-source / dead-bus supervision should be utilized in the non-generating mode.

**A3.1.6** waveform and event-capture of all opening and closing events, when such events are the result of system faults or other abnormal conditions on the BES. Captured event to be compatible with format mandated by Transmission Operator, Transmission Provider, and NERC. (Comment: External triggering/waveform capture may not always occur if SCADA or a person in the field manually opens a City Utilities breaker.)

**A3.1.7** digital communication compatibility with CU's SCADA system.

**A3.1.8** alarm capability to CU's dispatch for DC failure or relay failure.

**A3.1.9** real-time telemetry capability of interconnection watt and VAR flows when generating.

#### **A4.0 Typical protective relay functions required:**

- A4.1 Inputs:**
- <> 3-phase AC potentials and currents
  - <> Close command
  - <> Trip command
  - <> Transferred-trip command
  - <> Synchronism-check permissive
  - <> Alternate-settings mode
  - <> Breaker trip-coil monitor
  - <> Breaker-indication contact
- A4.2 Algorithms:**
- <> Breaker state
  - <> Nondirectional overcurrent trip
  - <> Directional overcurrent trip
  - <> Negative-sequence overcurrent trip
  - <> 3-phase over- and under-voltage trip
  - <> 3-phase over- and under-frequency trip
  - <> Breaker failure-to-trip alternative protection scheme
  - <> Breaker trip-circuit “open” alarm
  - <> Malfunctioning or inoperative protective relay alarm
  - <> Loss of control power alarm
  - <> Synchronism-check of breaker “close” command
  - <> Event-capture of each breaker operation
  - <> Waveform-capture of each breaker operation
  - <> Location, type, duration, and magnitude of fault
- A4.3 Outputs:**
- <> TRIP Command
  - <> CLOSE Command or synchronism-check permissive
  - <> LOCKOUT Command for failure-to-trip or malfunction
  - <> Alarms defined in section A4.2
  - <> Metering values for voltage and frequency
  - <> RS-232 or RS-485 communications port
  - <> Location, type, duration, and magnitude of fault

## APPENDIX B

### Relay Standards for Connected Load (End-User) Facilities

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#### **B1.0 NERC Planning Standards, Sec. I.C.:**

All facilities involved in the generation, transmission and use of electricity must be properly interconnected to the transmission systems to avoid degrading the reliability of the electric systems to which they are connected.

#### **B2.0 Requirements for facilities:**

##### **B2.1** General requirements:

**B2.1.a** End-User connected load facility shall generally be defined to be a Requesting Party's set of facilities that does not contain generation connected to its BES.

**B2.1.b** Protective relay schemes of Requesting Party shall be integrated and coordinated to operate with protective relay schemes of CU's facilities.

**B2.1.c** If End-User connected load includes generation facilities in parallel with CU's facilities, then Facility Connection Requirements Appendix A will also apply to Requesting Party.

**B2.2** Requesting Party equipment shall be capable of transferring data to and from CU's SCADA system.

**B2.3** Requesting Party is required to incorporate into its load profile such under-frequency and under-voltage relaying as required by Transmission Provider criteria and /or CU.

#### **B3.0 Outline of connection protective device features:**

**B3.1** Connection with Transmission System shall be appropriate for the requirements of the electrical-system protective schemes. Such connection may utilize fuses, circuit-switchers or circuit-breakers with appropriate control and protection schemes.

**B3.2** Fuse ratings shall be in accordance with CU standards and meet applicable utility industry design standards.

**B3.3** Protective relay response shall not exceed transformer-damage specifications.

**B3.4** Protective relay characteristics shall coordinate with CU's schemes.



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**B3.5** Digital communication protocol shall be compatible with CU's SCADA system.

**B4.0 Typical protective relay functions required:**

- B4.1** Inputs:
- <> 3-phase AC potentials and currents
  - <> Close command
  - <> Trip command
  - <> Breaker trip-coil monitor
  - <> Breaker-indication contact
- B4.2** Algorithms:
- <> Breaker state
  - <> Nondirectional overcurrent trip
  - <> Breaker failure-to-trip
  - <> Breaker trip-circuit "open" alarm
  - <> Malfunctioning or inoperative protective relay alarm
  - <> Loss of control power alarm
  - <> Event-capture of each breaker operation
  - <> Location, type, duration, and magnitude of fault
- B4.3** Outputs:
- <> TRIP Command
  - <> CLOSE Command or synchronism-check permissive
  - <> LOCKOUT Command for failure-to-trip or malfunction
  - <> Alarms defined in section B4.2
  - <> RS-232 or RS-485 communications port
  - <> Location, type, duration, and magnitude of fault



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**Date:** 12/10/2018  
**Distribution:** Public

## Revision History

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| Version | Date     | Action  | Change Tracking |
|---------|----------|---|-----------------|
| 0       | 4-1-05   | Created document – JK   | New             |
| 1       | 6-1-06   | Added text (requirements) – JK  | Update          |
| 2       | 9-22-06  | Added text (requirements) – JK  | Update          |
| 3       | 11-7-07  | Deleted effective date in Preface; corrected NERC council to corp. section 1.2; updated signature page - JK | Update          |
| 3       | 3-4-08   | Review - JK   | No changes      |
| 3       | 3-2-09   | Review - JK   | No changes      |
| 4       | 4-29-10  | Review, added reference to SPP Criteria and OATT – JK   | Update          |
| 5       | 7-29-10  | Review, Revised Preface, relaying & removed signature block – JK/WH   | Update          |
| 5       | 9-1-11   | Review – JK/WH  | No changes      |
| 6       | 10-11-12 | Review, minor edits – JK/WH   | Update          |
| 7       | 11-13-13 | Review; minor edits –JK/WH  | Update          |
| 8       | 11-13-14 | Review; minor edits -JK   | Update          |
| 8       | 12-16-15 | Review; minor edits - JK  | Update          |
| 8       | 12-6-16  | Review; minor edits - JK  | Update          |
| 8       | 1-3-18   | Review – JK   | No changes      |
| 9       | 12-10-18 | Review and updated-JK/JB  | Update          |
|         |          |   |                 |
|         |          |   |                 |