



FACILITY CONNECTION REQUIREMENTS

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CPS Energy Facility Connection Requirements

R1 PURPOSE

This document outlines CPS Energy's facility connection requirements for entities wishing to interconnect with the CPS Energy Transmission System. Once CPS Energy has adequately analyzed the interconnection impact upon its transmission system, the requirements will be further specified. The modified requirements can then be used for inclusion into any interconnection agreement drafted between CPS Energy and the interconnecting facility owner.

All proposed interconnecting facilities shall be designed and operated in accordance with any applicable requirements of ERCOT, NERC, NESC, OSHA, and other regulatory authorities. The proposed interconnecting facilities shall also be in accordance with the CPS Energy Facility Connection Requirements contained within this document. Interconnection of facilities shall not negatively impact either entity's system stability, reliability, operability, maintainability or utility. The CPS Energy Facility Connection Requirements will address connection requirements for:

- R1.1 GENERATION FACILITIES**
- R1.2 TRANSMISSION FACILITIES**
- R1.3 END-USER FACILITIES**

R2 REQUIREMENTS

The CPS Energy Facility Connection Requirements shall address the following items:

R2.1 SYSTEM PERFORMANCE

CPS Energy shall analyze and evaluate all interconnecting facilities in its Annual Assessment to ensure required system performance throughout the planning horizon.

R2.1.1 INTERCONNECTION STUDIES

Joint studies of new facilities and their impacts on the interconnected transmission system shall be performed as follows:

R2.1.1.1 GENERATION INTERCONNECTION

All new generation facilities with 10MW or greater capacity and all modified generation facilities with an increase of 10MW or greater capacity shall adhere to the facility connection requirements within this document and shall be in accordance with Section 3 "Open Access to the ERCOT Transmission Grid" of the ERCOT Protocols and all applicable NERC Standards. An interconnection study shall be performed by CPS Energy to determine the facility connection requirements. The interconnection study shall be performed in accordance with the ERCOT "Generation Interconnection or Change Request Procedures".

R2.1.1.2 TRANSMISSION INTERCONNECTION

All transmission system interconnections shall adhere to the facility connection requirements within this document and shall be in accordance with the ERCOT "Power System Planning Charter and Processes" and all applicable NERC Standards.

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Transmission system interconnections required to resolve planning criteria violations or to enhance system reliability are normally discovered through specific or annual planning studies performed by CPS Energy. The facility connection requirements are derived from the results of these studies.

R2.1.1.3 END-USER FACILITY CONNECTION

For use in this document, End-User Facility is defined as any interconnecting facility demand connected through substations to the transmission system.

All end-user facilities shall adhere to the facility connection requirements within this document and shall be in accordance with all applicable NERC Standards. The facility connection requirements for end-user facilities are derived through specific or annual planning studies performed by CPS Energy.

R2.1.2 INTERCONNECTION COORDINATION

Requirements for new or modified facilities, as a result of the interconnection studies, will be coordinated as follows:

R2.1.2.1 GENERATION INTERCONNECTION

The generation interconnection study is coordinated with the interconnecting facility owner, ERCOT, and ERCOT Transmission Owners in accordance with the ERCOT "Generation Interconnection or Change Request Procedures".

R2.1.2.2 TRANSMISSION INTERCONNECTION

The transmission interconnection studies and required changes are coordinated with the interconnecting facility owner and are submitted to the ERCOT Regional Planning Group for review as necessary.

R2.1.2.3 END-USER FACILITY CONNECTION

Results of the studies that identify end-user facility connection requirements are communicated with the interconnecting facility owner as required.

R2.1.3 VOLTAGE AND POWER CAPACITY OR DEMAND

Voltage

The CPS Energy Transmission System is comprised of 345kV and 138kV networks. The connection voltage will be determined from the interconnection study.

Power Capacity or Demand

The power capacity or demand (MVA, MW, MVAR, PF) will be determined from the interconnection study.

R2.1.4 BREAKER DUTY AND SURGE PROTECTION

Breaker Duty

AC high voltage circuit breakers shall be rated in accordance with ANSI/IEEE Standards C37 series for breakers rated on a "Symmetrical Current Basis." New transmission breakers should be provided with adequate margin to allow for system growth where applicable. End-user and generation facilities shall supply CPS Energy with breaker

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nameplate information for all breakers and fault-interrupting devices connected to the CPS Energy transmission system. End-user and generation facilities shall schedule breakers for replacement when the duty exceeds 95% of the breakers interrupting rating. Breakers shall not be allowed to exceed 100% of the interrupting rating. Breaker duty shall be determined by CPS Energy breaker rating studies based on methods in the ANSI/IEEE C37 Application Guides.

Surge Protection - Substation Equipment

Voltage sensitive devices to protect equipment and systems from high voltage surges, such as lightning, switching, and temporary over-voltages shall comply with CPS Energy Specification No. 774-07, (Arresters, Surge, Station Class, Metal-Oxide Varistor).

http://www.cpsenergy.com/Developers_Builders/New_Infrastructure/specifications/stdsspecs/774-07.pdf

Related Standard:

ANSI/IEEE C62.1 – American National Standard for Surge Arresters for AC Power Circuits.

The facility owner shall provide CPS Energy with a location plan and a simplified one-line diagram of the proposed plant and/or station facilities illustrating surge protection devices.

Surge Protection - Transmission Equipment

Should lightning or surge arrestors be utilized on the connecting transmission line for surge protection; the facility owner shall notify CPS Energy of arrestor size, configuration, etc. CPS Energy will notify the facility owner conversely.

R2.1.5 SYSTEM PROTECTION & COORDINATION

Interconnecting facilities are required to provide dependable and secure protective relay systems. The protective relay systems shall be designed to meet applicable ERCOT and NERC requirements and in accordance with good utility practices. The design must provide coordination for speed and sensitivity and shall not degrade the reliability of the CPS Energy transmission system. CPS Energy may require the submission of operation one-lines, relay one-lines, relaying schematics, relay types, proposed settings and equipment short circuit parameters for review and approval. CPS Energy reserves the right to specify relay types and setting requirements for interconnection with the CPS Energy transmission system. Additionally, the facility owner may be required to install under-frequency or under-voltage load shedding protection in accordance with ERCOT and NERC requirements in order to maintain acceptable levels of transmission reliability.

R2.1.6 METERING, TELECOMMUNICATIONS AND REMOTE SCADA SYSTEMS

Metering

Interconnecting entity shall provide metered quantities of MW, MVAR, and Volt at the point of interconnection to the CPS Energy transmission system. These values may be

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relay accuracy and will be used for SCADA, planning, or regulatory applications. Other meter point quantities/installations may be required for generation/load or special applications located at the interconnecting facility. CPS Energy will specify the accuracy, equipment type and location for these metering points. See the Telecommunications section for applicable protocol for metering data.

CPS Energy may require the installation of ERCOT settlement metering at the interconnecting facility. This will depend on the location of the point of interconnect in the transmission system and will be determined at the time of application.

Reasonable access must be provided by facility owner for the installation, testing and repair of metering equipment owned by CPS Energy.

All meter points shall be shown on the Relay One-line and schematic drawings, indicating ratios, device types and accuracies.

All metered points shall conform to NERC, State and Local requirements. Under no circumstances shall metering facilities constrain the transmission system. The meter point design shall conform to ERCOT Protocols and ERCOT Settlement Metering Operating Guide if applicable. All devices used in metering shall conform to or exceed applicable ANSI standards and ERCOT requirements if applicable. In the absence of appropriate ANSI standards, the devices shall conform to the EEI Handbook for Electrical Metering, latest edition.

Telecommunications

Dedicated communications circuits are required for premise equipment. i.e. Remote Terminal Units (RTU), telemetry equipment, etc.

Reasonable access must be provided by facility owner for the installation, testing and repair of RTU equipment, telemetry equipment, and communications circuits.

The design, purchase, installation, testing, maintenance, and replacement of the RTU equipment, telemetry equipment, and communications circuits will be the responsibility of the facility owner.

Voice communications via normal telephone lines or mutually agreed upon circuits.

Communications Systems designs should include redundancy and backup protection in accordance with good utility practices.

Provide adequate and reliable telecommunication facilities to ensure the exchange of interconnection and operating information. Where applicable these facilities shall be redundant and diversely routed.

Manage, alarm, test and/or actively monitor vital telecommunications facilities.

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Remote SCADA Systems

A. Protocol Requirements for Customer or CPS Energy owned RTU:

- DNP/IP or DNP serial communications is the required
- Possible considerations will be looked at if customer master does not support DNP
- UCA and Modbus protocols are not acceptable

B. Hardware Requirements for Customer owned RTU:

- Must provide CPS Energy a 10/100 Base T Ethernet (RJ45) DNP/IP or a RS232 (DB-9) serial DNP port for SCADA master scanning purposes

C. Hardware Requirements for CPS Energy owned RTU:

- Customer must provide all cabling necessary to connect to CPS Energy's DNP 10/100 Base T (RJ45) Ethernet or RS232 (DB-9) DNP serial port

D. Equipment Access Requirements:

- Customer must provide 24/7 access to CPS Energy equipment by CPS Energy personnel

R2.1.7 GROUNDING AND SAFETY ISSUES

Substation Equipment

Standards: ANSI/IEEE Std. 80 (Guide for Safety in AC Substation Grounding)
ANSI/IEEE Std.142 (Recommended Practice for Grounding of Industrial and Commercial Power Systems-Green Book)
ANSI Std. C33.8 (Standard for Grounding and Bonding Equipment)

Facilities connecting to the CPS Energy electrical network should meet the requirements of the above referenced ANSI/IEEE standards for information pertinent to safe grounding practices in an AC Substation.

Connecting facility safety requirements shall address the grounding of all exposed metal parts of switches, structures, transformers tanks, metal walkways, fences, steelwork of buildings, panels, etc., so that a person touching or near any of this equipment cannot receive a dangerous shock if high-tension conductors flash to or come in contact with any of the equipment listed. This means that each individual piece of equipment shall have its own connection to the station grounding system. These connections should be of heavy copper and should be protected against mechanical damage, should be bonded together, and tied into the main station ground.

The facility owner shall provide CPS Energy with a location plan and a simplified one-line diagram of the proposed plant and station facilities illustrating the Grounding of the equipment to be connected to the CPS network. A grounding study, if applicable, should also be submitted.

Transmission Equipment

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For transmission line grounding, all new transmission line facilities shall have one or more overhead shield wires. Single circuit transmission lines, in vertical or delta configurations, shall have at least one shield wire. Horizontally configured single circuit, double and triple circuit transmission lines shall have at least two shield wires.

If required by CPS Energy, the facility owner shall provide adequate transmission line grounding to mitigate lightning and surge flashovers by lowering foundation impedances with counterpoise and/or lightning rods, lightning arrestors and design implementations.

R2.1.8 INSULATION AND INSULATION COORDINATION

Substation Equipment

Standards: NEMA/IEEE Std. C29.1 – C29.9 (High Voltage Insulation Standards)
ANSI C92.1 - (Insulation Coordination)
IEEE 1313.1 – Standard for Insulation Coordination
IEEE 1313.2 – Guide for the application of Insulation Coordination

Facilities connecting to the CPS Energy electrical network should meet the requirements of the above referenced ANSI/IEEE/NEMA standards for information pertinent to Insulation and Insulation Coordination of the various items of equipment in a given proposed installation. Insulation coordination for the following voltages is covered by the standards listed above:

1. Power frequency voltages under normal operating conditions, i.e., not exceeding the maximum system voltage.
2. Temporary over voltages
3. Switching over voltages
4. Lightning over voltages

Transmission Equipment

Transmission line insulators shall be sufficiently sized for the applicable voltage level and insulator CFO values shall be communicated between CPS Energy and the connecting facility owner.

R2.1.9 VOLTAGE, REACTIVE POWER, AND POWER FACTOR CONTROL

Devices required to control voltage, reactive power flow, and power factor, such as capacitor banks, reactor banks, transformer tap changers, and generator reactive capability, will be determined by the interconnection study.

R2.1.10 POWER QUALITY

Purpose

This section presents the level of power quality expected for interconnect with the CPS Energy transmission system and the requirements for monitoring compliance.

Definitions

Owner: Interconnecting facility owners seeking to interconnect with the CPS Energy

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transmission system for the purpose of selling power to CPS Energy, purchasing power from CPS Energy, increase reliability or to transmit power through the CPS Energy transmission system to a third party.

Event: Any quantity that deviates outside the tolerance of CPS Energy Power Quality Standards.

Power Quality: The quality of the voltage and current wave forms at the interconnect point between the Owner and the CPS Energy transmission system.

General Terms and Condition

The Owner must respond in writing to CPS Energy before any agreement can take place and must agree to the following terms and conditions:

1. The Owner understands that power quality standards and requirements are subject to change at any time. Before any changes take place, CPS Energy will publish such changes and make them available well in advance to all Owners who are interconnected with the CPS Energy transmission system.
2. It is the responsibility of the Owner to remain updated and compliant with all CPS Energy Power Quality Interconnect Standards and Requirements.
3. The Owner shall furnish and install all equipment required to verify that the exchange satisfies the agreement with CPS Energy.
4. The Owner shall give CPS Energy the right to monitor at any time or continuously the electric power of the Owner to verify compliance. This includes but is not limited to installing power quality monitors at any location or premise owned or operated by the Owner.
5. The Owner shall take all necessary actions at their expense, including but limited to, installing power conditioning equipment to maintain the quality of power. The Owner will agree to update CPS Energy periodically with a disclosure of all such equipment and devices and their locations and actions taken to maintain compliance.
6. The Owner shall maintain reliable records and/or databases to continuously record and store accessible data to guarantee that it is possible at any time to use such accessible data to extract, calculate, analyze and demonstrate all or any of the power quality quantities for a minimum of two years preceding the time in which any event may have occurred. CPS Energy shall be provided the contents of such files, records and/or database upon verbal or written request.
7. The Owner shall inform CPS Energy in writing at least two weeks before any procedure that can or will cause an event..
8. CPS Energy shall have the right to disconnect its transmission system from the Owner system. CPS Energy will determine the timing and duration of the interruption. CPS Energy will consider reconnecting its transmission system to the Owner when CPS Energy has evidence that the electric energy of the Owner meets the Standards and Requirements of the agreement with the Owner. CPS Energy will determine the timing, conditions and details of the reconnection on a case by case basis.

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Power Quality Quantities

CPS Energy maintains and monitors the following Power Quality Quantities, standards and requirements:

1. Voltage

Any deviation from $\pm 5\%$ of the CPS Energy's nominal voltage for more than ten cycles (0.166 seconds) will be considered an event.

2. Voltage Unbalance

CPS Energy adopted the American National Standards Institute (ANSI) Standard C84.1–1989 to define the voltage unbalance.

$$\% \text{ Voltage Unbalance} = 100 * \frac{(\text{maximum deviation from average voltage})}{(\text{average voltage})}$$

A voltage unbalance that exceeds 2.5% over a demand period is an event.

3. Current Unbalance

CPS Energy maintains a current unbalance that is less than 5% at anytime and considers any current unbalance that is more than 5% to be an event.

$$\% \text{ Current Unbalance} = 100 * \frac{(\text{maximum deviation from average current})}{(\text{average current})}$$

4. Power Frequency

The operating frequency of the Owner generating equipment shall not deviate more than ± 0.5 Hertz (Hz) from the CPS Energy's nominal frequency of 60 Hz. The Owner shall automatically disconnect the generating equipment from CPS Energy within 15 cycles if this frequency tolerance cannot be maintained.

5. Synchronization

If the generation of the Owner became desynchronized with CPS Energy generation by more than ± 10 degrees phase angle difference (phase shift) for more than 15 cycles, CPS Energy will consider this to be an event.

6. Voltage Total Harmonic Distortion

Maintain a total harmonic distortion (THD) voltage in accordance with IEEE 519-1992. Any excursion beyond these limits is considered an event.

Voltage Distortion Limits		
Bus Voltage at the Point of Interconnection	Individual Voltage Distortion (%)	Voltage Total Harmonic Distortion (THD) (%)
69 kV and below	3.0	5.0
69.001 kV through 161 kV	1.5	2.5
161.001 kV and above	1.0	1.5

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7. Current Harmonic Distortion (Distortion Limit)

CPS Energy regulates Current Harmonic Distortion according to IEEE standard 519-1992 section 10.4. CPS Energy considers any deviation from the Current Harmonic Distortion limits specified in IEEE standard 519-1992 section 10.4 to be an event. Continuous violation must be mitigated.

8. Flicker

CPS Energy utilizes the IEEE Standards 519-1992 curve as a standard to measure the severity of flickers. Any measured voltage deviation of more than +5% of the IEEE 519-1992 Border Lines of Irritation curve is considered an event.

CPS Energy accepts an IEC (International Electrotechnical Commission) Standard 61000-4-15 flicker meter as a method of measuring flickers.

9. Power Factor

The Owner shall make all necessary Power Factor corrections at their expense, to 0.95 leading and 0.95 lagging before the interconnection points. Daily excursions will require either disconnect of the Owner system or an agreeable financial cost payable to CPS Energy to fund mitigation

R2.1.11 EQUIPMENT RATINGS

The minimum requirements for equipment ratings will be determined from the interconnection study.

R2.1.12 SYNCHRONIZING OF FACILITIES

Interconnecting facility owners with generation are responsible for synchronizing and properly connecting its electrical system to the CPS Energy system. Each facility shall have automatic or manual synchronizing capabilities with a synch check relay to supervise the synchronizing functions and shall be not be capable of connecting to a de-energized CPS Energy system unless given such authorization by CPS Energy.

R2.1.13 MAINTENANCE COORDINATION

Maintenance Coordination will be performed in accordance with Section 2.7 of the ERCOT Operating Guides and Section 8 of the ERCOT Protocols. If any maintenance outage has the potential to impact the other, the entity that will be affected must be contacted and given approval prior to the device(s) being removed from service.

When switching is required to isolate equipment involving both parties, appropriate switching orders will be issued by each entity. CPS Energy will issue a "Clearance" if protective grounds are to be installed. Otherwise, a "Procedure" will be issued to document the abnormal state. Both parties will install tags & locks on the associated field equipment and install tags on all SCADA controlled points. Recloser relays may be disabled for the Safety of Field Personnel or System Reliability when agreed to by both parties. This will be accompanied by the appropriate documentation and tags installed if applicable. In this particular instance, CPS Energy will issue a "Procedure".

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R2.1.14 ABNORMAL OPERATING CONDITIONS

Both entities must operate during abnormal conditions (frequency and voltage) as specified by section 4 of the ERCOT Operating Guides.

R2.1.15 INSPECTION REQUIREMENTS FOR EXISTING OR NEW FACILITIES

CPS Energy has no formal inspection requirements for existing or new facilities and feels that this should be at the discretion of the transmission owner, generation facility or end-user facility in accordance with good utility practices.

R2.1.16 COMMUNICATION PROCEDURES DURING NORMAL & EMERGENCY CONDITIONS

Any entity wishing to interconnect with CPS Energy must be registered and in good standings with ERCOT as specified in Section 16 of ERCOT Protocols. Normal and emergency operating procedures must be followed as specified in the ERCOT Guides and ERCOT Protocols. The entity wishing to interconnect with CPS Energy will provide a 24 hour primary and secondary contact number to discuss any operational issues on a real time basis.

R3 MODIFICATIONS

Any required modifications to this document shall be performed and documented as needed. Any required modifications to interconnection facilities, either from modification of this document or as identified through planning analyses or design changes, will be coordinated with the interconnecting facility owner and documented through revision of the associated interconnection agreement. The CPS Energy Facility Connection Requirements document and interconnection agreement documents shall be made available, within five business days, to NERC, ERCOT and the interconnecting facility owner.