



## TECHNICAL REQUIREMENTS FOR DISTRIBUTED GENERATION ON THE CPS DISTRIBUTION SYSTEM

### A. General

1. This document describes typical technical interconnection requirements. CPS may determine that certain specific interconnection locations and conditions require the installation of more sophisticated protective devices and operating schemes, especially when the facility is exporting power to CPS.
2. If CPS determines an application for parallel operation describes facilities that require additional devices and operating schemes, CPS shall make those additional requirements known to the Distributed Generator at the time the interconnection studies are completed.
3. **Point of Interconnection.** If the Point of Interconnection is defined in the Interconnection Agreement between CPS and the Distributed Generator, that definition overrides the following definition:

The Point of Interconnection is defined as the terminals of the Power Station Isolating Switch on the Distributed Generator's facility side.

### B. Design Considerations

1. The Distributed Generator equipment shall be designed in accordance with but not limited to UL Standards, IEEE Standards, the National Electrical Code, the National Electrical Safety Code, the ERCOT Operating Guides, CPS Electric Service Standards and any other applicable local, state or federal codes or standards.
2. The Distributed Generator's generator shall be equipped with protective hardware and software designed to prevent the generator from being connected to a de-energized CPS circuit.
3. The Distributed Generator's generator shall be equipped with the necessary protective hardware and software designed to prevent connection or parallel operation of the generating equipment with CPS's distribution system unless the CPS voltage and frequency is of normal magnitude.
4. Pre-certified equipment may be installed on CPS's distribution system in accordance with a CPS approved interconnection control and protection scheme without further review of the Distributed Generator's design by CPS. When the Distributed Generator is exporting to CPS using pre-certified equipment, the protective settings and operations shall be those specified by CPS.

5. The Distributed Generator shall be responsible for protecting its generating equipment in such a manner that CPS system outages, short circuits or other disturbances including zero sequence currents and ferroresonant over-voltages do not damage the Distributed Generator's generating equipment. The Distributed Generator's protective equipment shall also prevent unnecessary tripping of CPS breakers that would affect CPS's capability of providing reliable service to other customers.
6. If the Distributed Generator is two MW or larger or CPS determines (based on studies or reviewing test results) that a Distributed Generator may not trip properly when isolated from CPS's system, CPS shall provide (at the Distributed Generator's expense) a communication channel to support communication between CPS and the Distributed Generator's facility. The channel may be a leased telephone circuit or other mutually agreed upon medium.
7. Circuit breakers or other interrupting devices at the Point of Interconnection must be capable of interrupting maximum available fault current from either direction. Facilities larger than two MW and exporting to CPS shall have a redundant circuit breaker unless a listed device suitable for the rated application is used.
8. The Distributed Generator shall furnish and install a manual disconnect device that has a visual break that is appropriate to the voltage level (a disconnect switch, a draw-out breaker, or fuse block), and is accessible to CPS personnel, and capable of being locked in the open position. The Distributed Generator shall follow CPS's switching, clearance, tagging, and locking procedures, which CPS shall provide for the Distributed Generator.

#### **C. Prevention of interference.**

1. **Voltage.** The Distributed Generator will operate its generating equipment in such a manner that the voltage levels on CPS are in the same range as if the generating equipment were not connected to CPS's system. The Distributed Generator shall provide an automatic method of disconnecting the generating equipment from CPS if a sustained voltage deviation in excess of +5.0 % or -10% from nominal voltage persists for more than 2 seconds, or a deviation in excess of +10% or -30% from nominal voltage persists for more than ten cycles. The Distributed Generator may reconnect when CPS voltage and frequency return to normal range and the system is stabilized.
2. **Flicker.** The Distributed Generator's equipment shall not cause excessive voltage flicker on CPS's distribution system. This flicker shall not exceed 3.0% voltage dip, in accordance with Institute of Electrical and Electronics Engineers (IEEE) 519 as measured at the Point of Interconnection.
3. **Frequency.** The operating frequency of the Distributed Generator's generating equipment shall not deviate more than +0.5 Hertz (Hz) or -0.7 Hz from a 60 Hz base. The Distributed Generator shall automatically disconnect the generating equipment from CPS within 15 cycles if this frequency tolerance cannot be maintained. The Distributed Generator may reconnect when CPS voltage and frequency return to normal range and the system is stabilized.
4. **Harmonics.** In accordance with IEEE 519 the total harmonic distortion (THD) voltage shall not exceed 5.0% of the fundamental 60 Hz frequency nor 3.0% of the fundamental frequency for any individual harmonic when measured at the Point of Interconnection.

5. **Fault and line clearing.** The Distributed Generator shall automatically disconnect from CPS within ten cycles if the voltage on one or more phases falls below -30% of nominal voltage on CPS serving the Distributed Generator premises. This disconnect timing also ensures that the generator is disconnected from CPS prior to automatic re-close of breakers. The Distributed Generator may reconnect when CPS voltage and frequency return to normal range and the system is stabilized.

**D. Control, protection and safety equipment requirements specific to single phase generators of 50 kilowatts (kW) or less connected to CPS's system.**

Exporting to CPS may require additional operational or protection devices and will require coordination of operations with CPS. The necessary control, protection, and safety equipment specific to single-phase generators of 50 kW or less connected to secondary or primary systems include an interconnect disconnect device, a generator disconnect device, an over-voltage trip, an under-voltage trip, an over/under frequency trip, and a synchronizing check for synchronous and other types of generators with stand-alone capability.

**E. Control, protection and safety equipment requirements specific to three-phase synchronous generators, induction generators, and inverter systems.**

This section specifies the control, protection, and safety equipment requirements specific to three phase synchronous generators, induction generators, and inverter systems. Exporting to CPS may require additional operational or protection devices and will require coordination of operations with CPS.

1. **Three phase synchronous generators.** The Distributed Generator's generator circuit breakers shall be three-phase devices with electronic or electromechanical control. The Distributed Generator is solely responsible for properly synchronizing its generator with CPS. The excitation system response ratio shall not be less than 0.5. The generator's excitation system(s) shall conform, as near as reasonably achievable, to the field voltage versus time criteria specified in American National Standards Institute Standard C50.13-1989 in order to permit adequate field forcing during transient conditions. For generating systems greater than two MW the Distributed Generator shall maintain the automatic voltage regulator (AVR) of each generating unit in service and operable at all times. If the AVR is removed from service for maintenance or repair, CPS's System Operator shall be notified.
2. **Three-phase induction generators and inverter systems.** Induction generation may be connected and brought up to synchronous speed (as an induction motor) if it can be demonstrated that the initial voltage drop measured on CPS side at the point of common coupling is within the visible flicker stated in paragraph C.2. of this document. Otherwise, the Distributed Generator may be required to install hardware or employ other techniques to bring voltage fluctuations to acceptable levels. Line-commutated inverters do not require synchronizing equipment. Self-commutated inverters whether of CPS-interactive type or stand-alone type shall be used in parallel with CPS only with synchronizing equipment. Direct-current generation shall not be operated in parallel with CPS.
3. **Protective function requirements.** The protective function requirements for three phase facilities of different size and technology are listed below.
  - a) Facilities rated ten kilowatts (kW) or less must have an interconnect disconnect device, a generator disconnect device, an over-voltage trip, an under-voltage trip, an over/under frequency trip, and a manual or automatic synchronizing check (for facilities with stand alone capability).
  - b) Facilities rated in excess of ten kW but not more than 500 kW must have an interconnect disconnect device, a generator disconnect device, an over-voltage trip, an under-voltage trip, an over/under frequency trip, a manual or automatic synchronizing check (for facilities with stand alone capability), either a ground over-voltage trip or a ground over-current trip

depending on the grounding system if required by CPS, and reverse power sensing if the facility is not exporting (unless the generator is less than the minimum load of the Distributed Generator's facilities).

- c) Facilities rated more than 500 kW but not more than 2,000 kW must have an interconnect disconnect device, a generator disconnect device, an over-voltage trip, an under-voltage trip, an over/under frequency trip, either a ground over-voltage trip or a ground over-current trip depending on the grounding system if required by CPS, an automatic synchronizing check (for facilities with stand alone capability) and reverse power sensing if the facility is not exporting (unless the facility is less than the minimum load of the Distributed Generator). If the facility is exporting power, the power direction protective function may be used to block or delay the under frequency trip with the agreement of CPS.
  - d) Facilities rated more than 2,000 kW but not more than 10,000 kW must have an interconnect disconnect device, a generator disconnect device, an over-voltage trip, an under-voltage trip, an over/under frequency trip, either a ground over-voltage trip or a ground over-current trip depending on the grounding system if required by CPS, an automatic synchronizing check and AVR for facilities with stand alone capability, and reverse power sensing if the facility is not exporting (unless the facility is less than the minimum load of the Distributed Generator). If the facility is exporting power, the power direction protective function may be used to block or delay the under frequency trip with the agreement of CPS. A telemetry/transfer trip may also be required by CPS as part of a transfer tripping or blocking protective scheme.
4. **Requirements specific to a facility paralleling for sixty cycles or less (closed transition switching).** The protective devices required for facilities ten MW or less which parallel with CPS for 60 cycles or less are an interconnect disconnect device, a generator disconnect device, an automatic synchronizing check for generators with stand alone capability, an over-voltage trip, an under-voltage trip, an over/under frequency trip, and either a ground over-voltage trip or a ground over-current trip depending on the grounding system, if required by CPS.
5. **Inspection and start-up testing.** The Distributed Generator shall provide CPS with notice at least two weeks before the initial energizing and start-up testing of the Distributed Generator's generating equipment and CPS may witness the testing of any equipment and protective systems associated with the interconnection. The Distributed Generator shall revise and re-submit the application with information reflecting any proposed modification that may affect the safe and reliable operation of the CPS distribution system.
6. **Site testing and commissioning.** Testing of protection systems shall include procedures to functionally test all protective elements of the system up to and including tripping of the generator and interconnection point. Testing will verify all protective set points and relay/breaker trip timing. CPS may witness the testing of installed switchgear, protection systems, and generator. The Distributed Generator is responsible for routine maintenance of the generator and control and protective equipment. The Distributed Generator will maintain records of such maintenance activities, which CPS may review at reasonable times. For generation systems greater than 500 kW, a log of generator operations shall be kept. At a minimum, the log shall include the date, generator time on, and generator time off, and megawatt and megavar output. CPS may review such logs at reasonable times.
7. **Metering.** CPS shall supply (this may be at the Distributed Generator's expense depending on the applicable CPS tariff), own, and maintain all necessary meters and associated equipment to record energy purchases by the Distributed Generator and energy exports to CPS. The Distributed Generator shall supply at no cost to CPS a suitable location on its premises for the installation of CPS's meters and other equipment. If metering at the generator is required in such applications, metering that is

part of the generator control package will be considered sufficient if it meets all the measurements criteria that would be required by a separate stand alone meter.