



Distributed Generation Facilities Interconnection Requirements
City of Pasadena Water and Power Department

ATTACHMENT B

City of Pasadena
Water and Power Department
Power Division

DISTRIBUTED GENERATION FACILITIES INTERCONNECTION REQUIREMENTS

REGULATION 23

Adopted by Council Resolution **8304** on October 13, 2003
Revision 1: Amended by Council Resolution _____ on November 7, 2011



Distributed Generation Facilities Interconnection Requirements

City of Pasadena Water and Power Department

I. Mailing List Request

To be placed on a mailing list to receive update sheets of these regulations, fill out the form below and mail to:

Regulation 23 Mailing List
Pasadena Water and Power
150 S. Los Robles Avenue, Suite 200
Pasadena, CA 91101-2437

Attn: Utility Service Planning Bill Woods

DATE _____

NAME _____

COMPANY _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____



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II. TELEPHONE NUMBERS

Utility Service Advisors (626) 744-4495

FOR OTHER INQUIRIES:

Electric Rates..... (626) 744-4183

Energy Conservation (626) 744-6970

Emergency Service (24 hour number) (626) 744-4673

Inquiries Regarding Electric Bill (626) 744-4005

Inspection by Water and Power of
Underground Conducts and Vaults (24 hour service).. (626) 744-4467

To obtain quadrant of Utility Pole for Pole Risers (626) 744-4495

Inspection by Electrical Inspector of Community Development Department
For All New Wiring..... (626) 744-4200



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SCOPE AND PURPOSE

1. The Distributed Generation Facilities Interconnection Requirements constitute the Rules, Regulations and Policies of the City of Pasadena Water and Power Department (PWP) pertaining to distributed generation units connecting to the electric grid. This book is issued for the guidance and assistance of customers or Producers contemplating the installation of distributed generation, as well as electrical contractors, engineers, architects and manufacturers engaged in the installation and design of distributed generation.
2. The provisions of the Distributed Generation Facilities Interconnection Requirements are intended to be in accordance with the latest revision of the following regulation, but are not intended to be a substitute for said regulations:
 - ~~Rule 21, Generating facilities Interconnections~~
 - Underwriters Laboratory (UL) 1741
 - Institute of Electric and Electronic Engineers (IEEE) P1547
3. Distributed generation installation must meet the minimum requirements of the above regulations. When the requirements of Regulation 23 are more stringent than the above regulations, Regulation 23 will apply.
4. Any unusual situation or questions that are not covered in these regulations shall be referred to PWP ~~the Water and Power Department~~ for clarification in advance of commencing construction.



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Utility Interconnection Equipment Certification Form

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~~Interconnection and Metering Agreement~~



ELECTRIC REGULATION 23

DISTRIBUTED GENERATION FACILITIES INTERCONNECTION

A. DEFINITIONS

Definitions. Capitalized terms used in this Regulation, and not otherwise defined, shall have the meaning ascribed to such terms in this section. The definitions in this Regulation shall only apply to this Regulation and not to PWP's other regulations.

Certification Test: A test pursuant to this Regulation that verifies conformance of certain equipment with PWP-approved performance standards in order to be classified as Certified Equipment. Certification Tests are performed by NRTLs.

Certification; Certified; Certificate: The documented results of a successful Certification Testing.

Certified Equipment: Equipment that has passed all required Certification Tests.

Commissioning Test: A test performed during the commissioning of all or part of a Generating Facility to achieve one or more of the following:

- Verify specific aspects of its performance;
- Calibrate its instrumentation;
- Establish instrument or Protective Function set-points.

Customer: The entity that receives or is entitled to receive Distribution Service through PWP's Distribution System.

Dedicated Transformer; Dedicated Distribution Transformer: A transformer that provides electricity service to a single Customer. The Customer may or may not have a Generating Facility.

Distribution Service: All services required by, or provided to, a Customer pursuant to the approved rate schedules and Regulations by PWP.

Distribution System: All electrical wires, equipment, and other facilities owned or provided by PWP by which PWP provides Distribution Service to its Customers.

Emergency: An actual or imminent condition or situation, which jeopardizes the Distribution System integrity as determined by PWP.

Field Testing: Testing performed in the field to determine whether equipment meets PWP's requirements for safe and reliable Interconnection

Generating Facility: All Generators that are included in an Interconnection Agreement.

Generator: A device converting mechanical, chemical, or solar energy into electrical energy, including all of its protective and control functions and structural appurtenances. One or more Generators comprise a Generating Facility. ~~An individual electrical power plant (including required equipment, appurtenances, protective~~



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equipment and structures) that is capable of Distributed Generation. A Generator is part of a Generating Facility.

Gross Nameplate Rating: The total gross generating capacity of a Generator or Generating Facility as designated by the manufacturer of the Generator.

Host Load: Electrical power that is consumed by the Customer at the property on which the Generating Facility is located.

Initial Review: The review by PWP, following receipt of an Application, to determine the following: (a) The Generating Facility qualifies for Simplified Interconnection; or (b) the Generating Facility can be made to qualify for Interconnection with Supplemental Review determining any potential additional requirements; or (c) if neither (a) nor (b), provides the cost estimate and schedule for performing an Interconnection Study.

In-rush Current: The current determined by the In-rush Current Test.

Interconnection; (Interconnected): The physical connection of a Generating Facility in accordance with the requirements of this Regulation so that Parallel Operation with the Distribution System can occur (has occurred).

Interconnection Agreement: An agreement between PWP and the customer/Producer that gives certain rights and obligations to effect or end Interconnection.

Interconnection Facilities: The electrical wires, switches and related equipment that interconnect a Generating Facility to the Distribution System. Interconnection Facilities are part of their related Generating Facilities.

Interconnection Study: A study to establish the requirements for Interconnection of a Generating Facility.

Island, Islanding: A condition on the Distribution System in which one or more Generating Facilities deliver power to Customers using a portion of the Distribution System that is electrically isolated from the remainder of the Distribution System.

Line Section: That portion of the Distribution System connected to a Customer bounded by automatic sectionalizing devices or the end of the distribution line.

Momentary Parallel Operation: The interconnection of a Generating Facility to the Distribution System for one second (60 cycles) or less.

Nationally Recognized Testing Laboratory (NRTL): A laboratory accredited to perform the certification testing requirements under this Regulation.

Net Energy Metering: Metering for the receipt and delivery of electricity between the customer/Producer and PWP pursuant to Net Energy Metering service provisions of the PWP Electric Rate Schedule and/or Section 2827 of the Public Utilities Code. Over a given time frame (typically a month) the difference between these two values yields either net consumption or surplus. The meter registers are ratcheted to prevent reverse registration. If available, a single meter may be allowed to spin backward to yield the same effect as a directional, two-meter (or register) arrangement.

Net Generation Output Metering (AKA "Performance Metering"): Metering of the net electrical power output in kW or energy in kWh, from a given Generating Facility.



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This may also be the measurement of the difference between the total electrical energy produced by a Generator and the electrical energy consumed by the auxiliary equipment necessary to operate the Generator. For a Generator with no Host Load, metering that is located at the Point of Common Coupling. For a Generator with Host Load, metering that is located at the Generator but after the point of auxiliary load(s) and prior to serving Host Load.

Net Nameplate Rating: The Gross Nameplate Rating minus the consumption of electrical power of a Generator or Generating Facility as designated by the manufacturer(s) of the Generator(s).

Non-Export; Non-Exporting: Designed to prevent the transfer of electrical energy from the Producer to PWP.

Non-Islanding: Designed to detect and disconnect from a stable Unintended Island with matched load and generation. Reliance solely on under/over voltage and frequency trip is not considered sufficient to qualify as Non-Islanding.

Parallel Operation: The simultaneous operation of a Generator with power delivered or received by PWP while Interconnected. For the purpose of this Regulation, Parallel Operation includes only those generators that are interconnected with the Distribution System for more than one second (60 cycles).

Periodic Test: A test performed on part or all of a Generating Facility at pre-determined time or operational intervals to achieve one or more of the following:

- Verify specific aspects of its performance;
- Calibrate instrumentation;
- Verify and re-establish instrument or Protective Function set points.

Point of Common Coupling Metering: Metering located at the Point of Common Coupling. This is the same Metering as Net Generation Output Metering for Generating Facilities with no Host Load ~~or no Section 218 Load~~.

Point of Common Coupling: The transfer point for electricity between the electrical conductors of PWP and the electrical conductors of the Producer.

Point of Interconnection: The electrical transfer point between a Generator or a Generating Facility and the electrical system. This may or may not be coincident with the Point of Common Coupling.

Producer: The entity that executes an Interconnection Agreement with PWP. The Producer may or may not own or operate the Generating Facility, but is responsible for the rights and obligations related to the Interconnection Agreement.

Production Test: A test performed on each device coming off the production line to verify certain aspects of its performance.

Protective Function(s): The equipment, hardware or software in a Generating Facility (whether discrete or integrated with other functions) whose purpose is to protect against Unsafe Operating Conditions.

Prudent Electrical Practices: Those practices, methods, and equipment, as changed from time to time, that are commonly used in prudent electrical engineering and operations to design and operate electric equipment lawfully and with safety, dependability, efficiency, and economy.



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PWP: The City of Pasadena Water and Power Department

PWP Electric Rate Schedule: Pasadena Municipal Code Section 13.04, the Light and Power Rate Ordinance

~~**Section 218 Load:** Electrical power that is supplied in compliance with California Public Utilities Code Section 218. Public Utilities Code 218 defines an "Electric Corporation" and provides conditions under which a generator transaction would not classify a generating entity as an Electric Corporation. These conditions relate to "over-the-fence" sale of electricity from a generator without using the Distribution System.~~

Simplified Interconnection: Interconnection conforming to the minimum requirements under these Regulations, as determined by Section I.

Short Circuit Contribution Ratio (SCCR): The ratio of the Generating Facility's short circuit contribution to PWP's short circuit contribution for a three-phase fault at the high voltage side of the distribution transformer connecting the Generating Facility to PWP's system.

Single Line Diagram; Single Line Drawing: A schematic drawing, showing the major electrical switchgear, protection devices, wires, generators, transformers and other devices, providing sufficient detail to communicate to a qualified engineer the essential design and safety of the system being considered.

Stabilization; Stability: The return to normalcy of the PWP Distribution System, following a disturbance. Stabilization is usually measured as a time period during which voltage and frequency are within acceptable ranges.

Starting Voltage Drop: The percentage voltage drop at a specified point resulting from In-rush Current. The Starting Voltage Drop can also be expressed in percentage on a particular base voltage, (e.g. 6 volts on a 120-volt base, yielding a 5% drop).

Supplemental Review: A process wherein PWP further reviews an Application that fails one or more of the Initial Review Process screens. The Supplemental Review may result in one of the following: a) Simplified Interconnection; b) approval of Interconnection with additional requirements; or c) cost and schedule for an Interconnection Study.

System Integrity: The condition under which a Distribution System is deemed safe and can reliably perform its intended functions in accordance with the safety and reliability Regulations of PWP.

Telemetry: The electrical or electronic transmittal of metering data in real-time to PWP.

Transfer Trip: A Protective Function that trips a Generating Facility remotely by means of an automated communications link controlled by PWP.

Type Test: A test performed on a sample of a particular model of a device to verify specific aspects of its design, construction and performance.

Unintended Island: The creation of an island, usually following a loss of a portion of the Distribution System, without the approval of PWP.



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Unsafe Operating Conditions: Conditions that, if left uncorrected, could result in harm to personnel, damage to equipment, loss of System Integrity or operation outside pre-established parameters required by the Interconnection Agreement.

Visible Disconnect: An electrical switching device that can separate the Generating Facility from the Distribution System and is designed to allow visible verification that separation has been accomplished. This requirement can be met by opening the enclosure to observe the contact separation.

B. APPLICABILITY

Applicability. This Regulation describes the interconnection, operating and metering requirements for Generating Facilities to be connected to the Pasadena Water and Power (PWP) Distribution System pursuant to the PWP Electric Rate Schedule, Pasadena Municipal Code Section 13.04.178.

C. GENERAL REGULATIONS, RIGHTS AND OBLIGATIONS

- 1. Authorization Required to Operate.** A ~~customer~~Producer must comply with this Regulation, execute an Interconnection Agreement with PWP, and take electrical energy service pursuant to the PWP Electric Rate Schedule Pasadena Municipal Code Section 13.04.178.
- 2. Transmission Service Not Provided with Interconnection.** Interconnection with PWP's Distribution System under this Regulation does not provide a ~~customer~~Producer any rights to utilize PWP's Distribution System for the transmission or distribution, or wheeling of electric power.
- 3. Compliance with Laws, Regulations, and Tariffs.** A ~~customer~~Producer shall ascertain and comply with PWP Regulations, rate schedules, and applicable California Public Utilities Commission approved Regulations, tariffs, and regulations; and any local, state or federal law, statute or regulation which applies to the design, siting, construction, installation, operation, or any other aspect of the ~~customer~~Producer's Generating Facility and Interconnection Facilities.
- 4. Design Reviews and Inspections.** PWP shall review the design of a ~~customer~~Producer's Generating Facility and Interconnection Facilities and to inspect a ~~customer~~Producer's Generating and Interconnection Facilities prior to the commencement of Parallel Operation with PWP's Distribution System. PWP may require a ~~customer~~Producer to make modifications as necessary to comply with the requirements of this Regulation. PWP's review and authorization for Parallel Operation shall not be construed as confirming or endorsing the ~~customer~~Producer's design or as warranting the Generating or Interconnection Facilities' safety, durability or reliability. PWP shall not, by reason of such review or lack of review, be responsible for the strength, adequacy, or capacity of such equipment.



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5. **Right to Access.** A ~~customer~~Producer's Generating Facility and Interconnection Facilities shall be reasonably accessible to PWP personnel as necessary for PWP to perform its duties and exercise its rights under its rate schedules and Regulations, and any Interconnection Agreement between PWP and the ~~customer~~Producer.
6. **Prudent Operation and Maintenance Required.** A ~~customer~~Producer shall operate and maintain its Generating Facility and Interconnection Facilities in accordance with Prudent Electrical Practices and shall maintain compliance with this Regulation.
7. **Curtailment or Disconnection.** PWP may limit the operation or disconnect or require the disconnection of a ~~customer~~Producer's Generating Facility from PWP's Distribution System at any time, with or without notice, in the event of an Emergency, or to correct Unsafe Operating Conditions. However, PWP must provide written notice as soon as possible following such disconnect. PWP may also limit the operation or disconnect or require the disconnection of a ~~customer~~Producer's Generating Facility from PWP's Distribution System upon the provision of reasonable written notice: 1) to allow for routine maintenance, repairs or modifications to PWP's Distribution System; 2) upon PWP's determination that a ~~customer~~Producer's Generating Facility is not in compliance with this Regulation; or, 3) upon termination of the Interconnection Agreement. Upon the ~~customer~~Producer's written request PWP shall provide a written explanation of the reason for such curtailment or disconnection.

D. APPLICATION AND INTERCONNECTION PROCESS

1. Application Process

- a. **Applicant Initiates Contact with PWP.** Upon request, PWP will provide information and documents (such as sample agreements, the Application, technical information, listing of Certified Equipment, application fee information, applicable rate schedules and metering requirements) in response to a potential applicant's inquiry. PWP will establish an individual representative as the single point of contact for an applicant, but may allocate responsibilities among its staff to best coordinate the Interconnection of an applicant's Generating Facility.
- b. **Applicant Completes and Files an Application.** All applicants shall be required to complete and file an Application and supply any relevant additional information requested by PWP. The filing must include the completed Application and a fee for processing the application and performing the Initial Review to be completed by PWP pursuant to Section D.1.c. The application fee shall vary with the type of the proposed Generating Facility as follows:



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Type of Service	Initial Review	Supplemental Review
Net Energy Metering (per Public Utilities Code Section 2827)	None	None
All others	\$800	\$600 (additional)

Fifty percent of the fees associated with the Initial Review will be returned to the applicant if the Application is rejected by PWP or the applicant retracts the Application.

The applicant may propose and PWP may negotiate specific costs for processing non-standard applications such as multi-units, multi-sites, or otherwise as conditions warrant. The costs for the Initial Review and the Supplemental Review contained in this Section, as well as the language provided in Sections D.1.c and D.1.d, do not apply under these circumstances.

If deficiencies in the application are noted, PWP and applicant shall cooperate in a timely manner to establish a satisfactory Application.

c. PWP Performs an Initial Review and Develops Preliminary Cost Estimates and Interconnection Requirements.

- 1) Upon receipt of a satisfactorily completed Application and any additional information necessary to evaluate the Interconnection of a Generating Facility, PWP shall perform an Initial Review using the process defined in Section I. The Initial Review determines if (a) the Generating Facility qualifies for Simplified Interconnection, (b) the Generating Facility can qualify for Interconnection subject to additional requirements, or (c) it will be necessary for PWP to perform an Interconnection Study to determine the Interconnection Requirements.
- 2) PWP shall complete its Initial Review, absent any extraordinary circumstances, upon determination that the Application is complete, if the Generating Facility qualifies for Simplified Interconnection. If the Initial Review determines that the proposed facility can be interconnected by means of a Simplified Interconnection, PWP will provide the applicant with a written description of the requirements for interconnection and a draft Interconnection Agreement pursuant to Section D.1.e.
- 3) If the Generating Facility does not qualify for Simplified Interconnection as proposed, PWP will notify the applicant and perform a Supplemental Review as described in Section I. The Supplemental Review will provide either (a) Interconnection Requirements beyond those for



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Simplified Interconnection, and a draft Interconnection Agreement, or
(b) a cost estimate and schedule for an Interconnection Study.

- d. **When Required, Applicant and PWP Commit to Additional Interconnection Study Steps.** When an Initial Review reveals that the proposed facility cannot be interconnected to PWP's Distribution System by means of a Simplified Interconnection, or that significant PWP Interconnection Facilities or Distribution System improvements must be installed or made to PWP's Distribution System to accommodate the interconnection of an applicant's Generating Facility, PWP and applicant shall sign the "City of Pasadena Utility Services Contract" ~~in the form attached hereto as Appendix 3~~ for PWP to perform additional studies, facility design, and engineering and to provide detailed cost estimates for fixed price or actual cost billing, to the applicant at the applicant's expense. The Contract shall set forth PWP's schedule for completing such work and the estimated or fixed price costs of such studies and engineering. Upon completion of an Interconnection Study, PWP shall provide the applicant with the specific requirements, costs and schedule for interconnecting the Generating Facility to accommodate execution of agreements pursuant to Section D.1.e
- e. **Applicant and PWP Enter Into an Interconnection Agreement.** The applicant shall sign the applicable form of Interconnection Agreement ~~in the form attached hereto as Appendix 2~~. Current standard Interconnection Agreement forms are posted on the internet at www.pwpweb.com or may be obtained by contacting PWP Utility Services Planning division.
- f. **Where Applicable, PWP or Customer/Producer Installs Required Interconnection Facilities or Modifies PWP's Distribution System.** After signing the Interconnection Agreement, customer/Producer will commence construction/installation of the modifications or metering and monitoring requirements identified in the Interconnection agreement. The parties will use good faith efforts to meet the schedules and cost estimates.
- g. **Customer/Producer Arranges for and Completes Commissioning Testing of Generating Facility and, Where Applicable, customer/Producer Installed Interconnection Facilities.** The customer/Producer shall successfully demonstrate to PWP's satisfaction that Generating Facilities and associated Interconnection Facilities, comply with the safety and reliability provisions of this Regulation, and PWP Regulations and regulations prior to being operated in parallel with PWP's Distribution System.
- h. **PWP Authorizes Parallel Operation or Momentary Parallel Operation.** The customer/Producer's Generating Facility shall be allowed to operate in Parallel Operation or Momentary Parallel Operation, as applicable, with PWP's Distribution System upon satisfactory compliance with the terms of all applicable agreements. Compliance may include, but not be limited to,



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provision of any required documentation and satisfactorily completing any required inspections or tests as described herein or in the Interconnection Agreement formed between the customerProducer and PWP.

E. GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS

1. General Interconnection and Protection Requirements

- a. **Protective Functions Required.** The Protective Functions for Generating Facilities operating in parallel with PWP's Distribution System shall include:
 - 1) Over and under voltage trip functions and over and under frequency trip functions;
 - 2) A means for disconnecting the Generating Facility from PWP's Distribution System when a protective function initiates a trip;
 - 3) An automatic means to prevent the Generating Facility from energizing a de-energized Distribution System circuit and to prevent the Generating Facility from reconnecting with the Distribution System unless the Distribution System service voltage and frequency is of specified settings and is stable for at least 60 seconds;
 - 4) A means to prevent the Generating Facility from contributing to the formation of an Unintended Island.
- b. **Momentary Paralleling Generating Facilities.** With PWP's approval, the transfer switch or system used to transfer the customerProducer's loads from PWP's Distribution System to customerProducer's Generating Facility may be used in lieu of the Protective Functions required for Parallel Operation.
- c. **Purpose of Protective Functions.** The Protective Functions and requirements of this Regulation are designed to protect PWP's Distribution System and not the Generating Facility. A customerProducer shall be solely responsible for providing adequate protection for its Generating Facility and Interconnection Facilities. The customerProducer's protective equipment shall not impact the operation of other protective devices utilized on the Distribution System in a manner that would affect PWP's capability of providing reliable service to its customerProducers.
- d. **Suitable Equipment Required.** Circuit breakers or other interrupting devices located at the Point of Common Coupling must be Certified or "Listed" (as defined in Article 100, the Definitions Section of the National Electrical Code) as suitable for their intended application. This includes being capable of interrupting the maximum available fault current expected at their location. CustomerProducer's Generating Facility and Interconnection Facilities shall be designed so that the failure of any one device shall not potentially compromise the safety and reliability of PWP's Distribution System.



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- e. **Visible Disconnect Required.** The ~~customer~~Producer shall furnish and install a manual disconnect device that has a Visible Disconnect to isolate the Generating Facility from PWP's Distribution System. The device must be accessible to PWP personnel and be capable of being locked in the open position. Generating Facilities with Non-Islanding inverters totaling 1 kVA or less are exempt from this requirement.
- f. **Single-Phase Generators.** For single-phase Generators connected to a shared single-phase secondary system, the maximum Net Nameplate Rating of the Generating Facilities shall be 20 kVA. Generators applied on a center-tapped neutral 240-volt service must be installed such that no more than 6 kVA of imbalance in capacity exists between the two sides of the 240-volt service. For Dedicated Distribution Transformer services, the maximum Net Nameplate Rating of a single-phase Generating Facility shall be the transformer nameplate rating.
- g. **Drawings Required.** PWP, prior to Parallel Operation or Momentary Parallel Operation of the Generating Facility, shall approve the ~~customer~~Producer's protection and control diagrams of the Generating Facility. Generating Facilities equipped with a protection and control scheme previously approved by PWP for system-wide application or with Certified Equipment only may satisfy this requirement by reference to previously approved drawings and diagrams.
- h. **Generating Facility Conditions Not Identified.** In the event this Regulation does not address the interconnection requirements for a particular Generating Facility, PWP and ~~customer~~Producer may agree upon other requirements.

2. Prevention of Interference.

The ~~customer~~Producer shall not operate equipment that superimposes upon PWP's Distribution System a voltage or current that interferes with PWP operations, service to PWP ~~customer~~Producers, or PWP communication facilities. If such interference occurs, the ~~customer~~Producer must diligently pursue and take corrective action at its own expense after being given notice and reasonable time to do so by PWP. If the ~~customer~~Producer does not take timely corrective action, or continues to operate the equipment causing interference without restriction or limit, PWP may, without liability, disconnect the ~~customer~~Producer's equipment from the Distribution System, in accordance with Section C.7 of this Regulation.

To eliminate undesirable interference caused by operation of the Generating Facility, each Generating Facility shall meet the following criteria:



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- a. **Normal Voltage Operating Range.** The voltage operating range limits for Generating Facilities shall be selected as a protection function that responds to abnormal Distribution System conditions and not as a voltage regulation function.
- 1) **Generating Facilities (11 kVA or less).** Generating Facilities with a Gross Nameplate Rating 11 kVA or less shall be capable of operating within the limits normally experienced on the Distribution System. The operating range shall be selected in a manner that minimizes nuisance tripping between 106 volts and 132 volts (88-110% of nominal voltage) on a 120-volt base. Generating Facilities shall cease to energize PWP circuits whenever the voltage at the Point of Common Coupling deviates from the allowable voltage operating range.
 - 2) **Generating Facilities (Greater than 11 kVA).** PWP may have specific operating voltage ranges for Generating Facilities with Gross Nameplate Ratings greater than 11 kVA and may require adjustable operating voltage settings. In the absence of such requirements, the Generating Facility shall operate at a range between 88% and 110% of the applicable interconnection voltage.
 - 3) **Voltage Disturbances.** System voltage assumes a nominal 120 V base. The Generator should sense abnormal voltage and respond accordingly. The following conditions should be met, with voltages in root mean square and measured at the Point of Common Coupling, as described in Table D-1.



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Table D-1: Voltage Trip Setting

Voltage at Point of Common Coupling (Assuming 120V base)	Maximum Trip Setting (Assuming 60 cycles per Second)
Less than 60 Volts	10 cycles
Greater than or equal to 60 Volts but less than 106 Volts	120 cycles
Greater than or equal to 106 volts but less than or equal to 132 Volts	Normal Operation
Greater than 132 volts but less than or equal to 165 Volts	120 cycles (30 cycles for facilities greater than 11 kVA)
Greater than 165 Volts	6 cycles

**"Maximum Trip time" refers to the time between the onset of the abnormal condition and the Generating Facility ceasing to energize the Distribution System. Protective Function sensing devices and circuits may remain connected to the Distribution System to allow sensing of electrical conditions for use by the "reconnect" feature. The purpose of the time delay is to allow a Generating Facility to "ride through" short-term disturbances to avoid nuisance tripping. For Generating Facilities with a Gross Nameplate Rating of 11 kVA or less, the set points are to be non-user adjustable. For Generating Facilities with a Gross Nameplate Rating greater than 11 kVA, different voltage set points and trip times from those in Table D-1 may be negotiated with PWP.*

- b. Flicker.** Any voltage flicker at the Point of Common Coupling caused by the Generating Facility should not exceed the limits defined by the "Maximum Borderline of Irritation Curve" identified in IEEE 519 (IEEE Recommended Practices and Requirements for Harmonic Control in Electric Power Systems, IEEE STD 519-1992, Institute of Electrical and Electronic Engineers, Piscataway, NJ. April 1992.) This requirement is necessary to minimize the adverse voltage effects experienced by other customers on PWP's Distribution System. Induction Generators may be connected and brought up to synchronous speed (as an induction motor) provided these flicker limits are not exceeded.
- c. Frequency.** PWP controls system frequency, and the Generating Facility shall operate in synchronism with the Distribution System. Generating Facilities with a Gross Nameplate Rating of 11 kVA or less shall have a fixed operating frequency range of 59.3-60.5 Hertz. The Generating Facility must cease to energize PWP's Distribution System in a maximum of ten cycles should Distribution System remain outside of the frequency limits. The purpose of the time delay is to allow the Generating Facility to ride through short-term disturbances to avoid nuisance tripping. PWP may require adjustable operating frequency settings for Generating Facilities with a Gross Nameplate Rating greater than 11 kVA.



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- d. **Harmonics.** Harmonic distortion shall be in compliance with IEEE 519. Exception: The harmonic distortion of a Generating Facility located at a ~~customer~~Producer's site shall be evaluated using the same criteria as for the loads at that site.
- e. **Direct Current Injection.** Generating Facilities should not inject Direct Current greater than 0.5% of rated output current into PWP's Distribution System.
- f. **Power Factor.** Each Generator in a Generating Facility shall be capable of operating at some point within a power factor range of 0.9 leading and 0.9 lagging. Operation outside this range is acceptable provided the reactive power of the Generating Facility is used to meet the reactive power needs of on-site loads or that reactive power is otherwise provided under tariff by PWP. The ~~customer~~Producer shall notify PWP if it is using the Generating Facility for power factor correction.

3. Control, Protection and Safety Equipment Requirements

a. Technology Specific Requirements

- 1) **Three-Phase Synchronous Generators.** For three-phase Generators, the circuit breakers shall be three-phase devices with electronic or electromechanical control. The ~~customer~~Producer shall be responsible for properly synchronizing its Generating Facility with the Distribution System by means of either a manual or automatic synchronizing function. Automatic synchronizing is required for all synchronous generators, which have a Short Circuit Contribution Ratio (SCCR) exceeding 0.05. A Generating Facility whose SCCR exceeds 0.05 shall be equipped with Protective Functions suitable for detecting loss of synchronism and rapidly disconnecting the Generating Facility from the Distribution System. Unless otherwise agreed to between the ~~customer~~Producer and PWP, synchronous generators shall automatically regulate power factor, not voltage, while operating in parallel with the Distribution System. Power system stabilization functions are specifically not required for Generating Facilities under 10 MW Net Nameplate Rating. Synchronization means that at the time of connection, the frequency difference shall be less than 0.2 Hz, the voltage difference shall be less than 10%, and the phase angle difference shall be less than 10 degrees.
- 2) **Induction Generators.** Induction Generators do not require a synchronizing function. Starting or Rapid fluctuations on induction generators can adversely impact the Distribution System's voltage. Corrective step-switched capacitors or other techniques may be necessary and may cause undesirable ferro-resonance. When these counter measures (e.g. additional capacitors) are installed on the ~~customer~~Producer's side of the Point of Common Coupling, PWP must



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review these measures. Additional equipment may be required as determined in a Supplemental Review or an Interconnection Study.

- 3) **Inverter Systems.** Utility-interactive inverters do not require separate synchronizing equipment. Non-utility-interactive or “stand-alone” inverters shall not be used for parallel operation with the Distribution System.

b. Supplemental Generating Facility Requirements

- 1) **Unintended Islanding For Generating Facilities that fail the Export Screen (Section J.3.b).** Generating Facilities must mitigate their potential contribution to an Unintended Island. This can be accomplished by one of the following options: (1) incorporating certified Non-Islanding control functions into the Protective Functions, or (2) verifying that local loads sufficiently exceed the Net Nameplate Rating of the Generating Facility, or (3) incorporating a transfer trip or an equivalent Protective Function.
- 2) **Fault Detection.** A Generating Facility with an SCCR exceeding 0.1 or that does not meet any one of the options for mitigating Unintended Islands in D.3.b.1 shall be equipped with Protective Functions designed to detect Distribution System faults, both line-to-line and line-to-ground, and promptly cease to energize the Distribution System in the event of a fault. For a Generating Facility that cannot detect these faults within two seconds, a transfer trip or equivalent function may be required. Reclose-blocking of PWP's affected recloser(s) may also be required by PWP for generators that exceed 15% of the peak load on the Line Section.

F. INTERCONNECTION FACILITY OWNERSHIP

1. Scope and Ownership of Interconnection Facilities

- a. **Scope.** The interconnection of a ~~customer~~Producer's Generating Facility with PWP's Distribution System is made through the use of Interconnection Facilities. Such interconnection may also require Distribution System improvements. The type, extent and costs of Interconnection Facilities and Distribution System Improvements shall be consistent with this Regulation and determined through the Initial Review and Interconnection Study described in Section D.
- b. **Ownership.** Interconnection Facilities installed on ~~customer~~Producer's side of the Point of Common Coupling may be owned, operated and maintained by the ~~customer~~Producer or PWP. Interconnection Facilities installed on PWP's side of the Point of Common Coupling and Distribution System improvements shall be owned operated and maintained by PWP.



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2. Responsibility for Costs of Interconnecting a Generating Facility

- a. **Study and Review Costs.** A ~~customer~~Producer shall be responsible for the reasonably incurred costs of the reviews and studies conducted pursuant to Section D.1 of this Regulation.
- b. **Facility Costs.** A ~~customer~~Producer shall be responsible for all costs associated with Interconnection Facilities owned by the ~~customer~~Producer. The ~~customer~~Producer shall also be responsible for any costs reasonably incurred by PWP in providing, operating, or maintaining Interconnection Facilities and Distribution System improvements required solely for the interconnection of the ~~customer~~Producer's Generating Facility with PWP's Distribution System, unless otherwise prohibited by law. ~~See Pasadena Municipal Code Section 13.04.178 (6).~~
- c. **Separation of Costs.** Should PWP combine the installation of Interconnection Facilities, or Distribution System Improvements with modifications or additions to PWP's Distribution System to serve other Customers ~~or customers~~, PWP shall not include the costs of such separate or incremental facilities in the amounts billed to the ~~customer~~Producer for the Interconnection Facilities or Distribution System Improvements required pursuant to this Regulation.

G. METERING, MONITORING AND TELEMETRY

1. **General Requirements.** All Generating Facilities shall be metered in accordance with this Section and shall meet all applicable standards of PWP's applicable rate schedules, Regulations, and published PWP Regulations dealing with metering specifications.
2. **Metering.** The ownership, installation, operation, reading, and testing of metering for Generating Facilities shall be by PWP.
 - a. **Net Generation Output Metering.** For purposes of monitoring Generating Facility operation for determination of standby charges and applicable non-bypassable charges as defined in the PWP Electric Rate Schedule ~~PWP's rate schedules, to satisfy applicable California Independent System Operator (CAISO) reliability requirements,~~ and for Distribution System planning and operations, consistent with Section C.3 of these Regulations, PWP shall specify the type, and require the installation of, Net Generation Output Metering. PWP shall require the provision of generator output data to the extent reasonably necessary to provide information for the utility to administer its tariffs or to operate and plan its system.
3. **Point of Common Coupling Metering.** For purposes of assessing PWP charges for retail service, the ~~Electricity~~ ~~customer~~Producer's Point of Common Coupling Metering shall be a bi-directional meter so that power deliveries to and from the ~~Electricity~~ ~~customer~~Producer's site can be separately recorded. Alternately, the



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~~Electricity customer~~Producer may, at its sole option and cost, require PWP to install multi-metering equipment to separately record power deliveries to the Distribution System and retail purchases from PWP. Such Point of Common Coupling Metering shall be designed to prevent reverse registration.

4. **Telemetry.** If the nameplate rating of the Generating Facility is 1 MW or greater, telemetry equipment at the Net Generator Metering location may be required at the ~~Electricity customer~~Producer's (and Customer's) expense. If the Generating Facility is interconnected to a Distribution System operating at a voltage below 10 kV, then Telemetry equipment may be required on Generating Facilities 250 kW or greater. PWP shall only require Telemetry to the extent that less intrusive and more cost effective options for providing the necessary data in real time are not available.
5. **Location.** Where PWP-owned metering equipment is located on the ~~Electricity customer~~Producer's premises, ~~customer~~Producer shall provide, at no expense to the PWP, a suitable location for all such metering equipment.

H. DISPUTE RESOLUTION PROCESS

Any disputes arising from this Regulation shall be submitted in writing to the General Manager of PWP.

I. INITIAL REVIEW PROCESS FOR APPLICATIONS TO INTERCONNECT A GENERATING FACILITY

1. **Introduction.** This Initial Review Process was developed to create a path for selection and rapid approval for the Interconnection of those Generating Facilities that do not require an Interconnection Study. The Initial Review process includes a screening to determine if a supplemental review is required.
2. **Purpose.** The Initial Review determines:
 - a. If a Generating Facility qualifies for Simplified Interconnection;
 - b. If a Generating Facility can be made to qualify for Interconnection with Supplemental Review determining any potential additional requirements, or
 - c. If an Interconnection Study is required, the cost estimate and schedule for performing the Interconnection Study.

NOTE: Failure to pass any screen of the Initial Review means only that further review or studies are required before the Generating Facility can be approved for interconnection with the PWP Distribution System. It does not mean that the Generating Facility cannot be interconnected.