



**INTERCONNECTION, METERING, AND
OPERATING REQUIREMENTS FOR GENERATING FACILITIES**

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A. APPLICABILITY

This Appendix F of the SFPUC Rules & Regulations describes additional interconnection, metering, and operating requirements for customer owned Generating Facilities to be connected to the San Francisco Public Utilities Commission (SFPUC) Electric Distribution System.

In order to provide for uniformity and to encourage the interconnection of renewable energy generation, this Appendix is intended to be generally consistent with the technical requirements of California Public Utilities Commission (CPUC) Rule 21 and IEEE 1547, as amended.

Language from IEEE 1547 that has been adopted directly (as opposed to paraphrased) is followed by a citation that lists the clause from which the language is derived. For example, IEEE 1547-4.1.1 is a reference to Clause 4.1.1.

In the event of any conflict between this Rule and any of the CPUC Rule 21 and IEEE 1547 standards listed herein, the requirements of this Rule shall take precedence.

B. GENERAL RULES, RIGHTS AND OBLIGATIONS

- 1. Prior Authorization Required to Interconnect and Operate.** An executed Interconnection Agreement is required in addition to receiving SFPUC's express written permission before Parallel Operation of a Generating Facility (including energy storage) with SFPUC's Distribution System. SFPUC shall apply this Appendix in a non-discriminatory first come, first served manner, and shall not unreasonably withhold its permission for Parallel Operation of Generating Facilities with SFPUC's Distribution System.
- 2. Separate Agreements Required for Other Services.** Separate Agreements are required for the provision of other Electric Services from SFPUC including, but not limited to, electric service agreements provided by SFPUC in accordance with SFPUC's Rules & Regulations, and Net Energy Metering Agreements when applicable.
- 3. Service Rights Not Provided with Interconnection.** Unless expressly agreed upon in writing, interconnection with SFPUC's Distribution System under this Rule provides no customer rights to utilize SFPUC's Distribution System for the transmission, distribution, or wheeling of electric power for any reason other than that afforded by Net Energy Metering. SFPUC shall maintain sole approval and control of the Net Energy Metering configurations.
- 4. Compliance with Laws, Rules & Regulations, and Utility Rates.** Applicants shall ascertain and comply with applicable SFPUC Rules & Regulations and Utility Rates, applicable Federal Energy Regulatory Commission (FERC) approved rules, 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 Applicant's Generating Facility and Interconnection Facilities.

5. Design Reviews and Inspections. SFPUC has the right to review the design of an Applicant's Generating Facility and Interconnection Facilities and to inspect the Generating Facility and/or Interconnection Facilities prior to the commencement of Parallel Operation with SFPUC's Distribution System. SFPUC may require Applicants to make modifications as necessary to comply with the requirements of SFPUC Rules and Regulations or other reasonable requirements. SFPUC's review and authorization for Parallel Operation shall not be construed as confirming or endorsing the Applicant's design or as warranting the Generating Facility and/or Interconnection Facilities' safety, durability, or reliability. SFPUC is not responsible for the adequacy or capacity of such Facilities.
6. Right to Access. Customer Generating and Interconnection Facilities shall be accessible to SFPUC personnel whenever necessary for SFPUC to perform its duties and exercise its rights under its Rules and Regulations and any Interconnection Agreement.
7. Prudent Operation and Maintenance Required. The Customer shall operate and maintain its Generating Facility and Interconnection Facilities in accordance with prudent electrical practices and shall maintain compliance with SFPUC Rules and Regulations.
8. Curtailment and Disconnection. SFPUC may limit the operation, disconnect, or require the disconnection of a Customer's Generating Facility from SFPUC's Distribution System at any time, with or without notice, in the event of an emergency, or to correct unsafe operating conditions. SFPUC may also limit the operation, disconnect, or require the disconnection of a Customer's Generating Facility from SFPUC's Distribution System with reasonable written notice: (1) to allow for routine maintenance, repairs, or modifications to SFPUC's Distribution System; (2) upon SFPUC's determination that a Customer's Generating Facility is not in compliance with any SFPUC Rules and Regulations; or (3) upon termination of the applicable Interconnection Agreement. Within a reasonable period after the Customer's written request, SFPUC will provide a written explanation of the reason for such curtailment or disconnection.
9. Coordination with Affected Systems. SFPUC will notify the Affected System Operators that are potentially affected by an Applicant's Interconnection Application(s). SFPUC will coordinate the conduct of any studies required to determine the impact of the Interconnection Application on Affected Systems

with Affected System Operators and, if possible, include those results in its Interconnection Study. SFPUC will invite such Affected System Operators to all meetings held with Applicant as required by this Rule. Applicants and transmission providers which may be an Affected System shall cooperate with SFPUC in all matters related to the conduct of relevant studies and the determination of modifications to Affected Systems. Applicant shall enter into an agreement with the owner of the Affected System, as applicable and upon request by SFPUC. The agreement will specify the terms governing payments to be made by the Applicant to the owner of the Affected System as well as the repayment, if applicable, by the owner of the Affected System.

10. Transferability of Interconnection Application. An Applicant may request to transfer its Interconnection Application to another entity only if such entity acquires the proposed Generating Facility identified in the Interconnection Application and the Point of Interconnection and operating parameters do not change. SFPUC at its discretion may deny such requests if SFPUC determines applicable requirements will not be met as a result of the transfer.

C. APPLICATION AND INTERCONNECTION PROCESS

1. APPLICATION PROCESS

- a. Interconnection Application (Application). To apply for the interconnection and operation of a customer owned Generating Facility, all applicants must complete and submit an Interconnection Application and three (3) sets of plan drawings to their SFPUC Customer Account Manager.
- b. Special Provisions Applicable to Net Energy Metering Applicants (NEM). Net Energy Metering programs are available to qualifying customers. To apply, customers must submit a Net Energy Metering application in addition to an Interconnection Application. Applications are available online at <https://www.sfpuc.org/hetch-hetchy-power-net-energy-metering-programs>.

2. OVERVIEW OF THE INTERCONNECTION REVIEW PROCESS

- a. Valid Interconnection Application. After an Application is received and deemed complete and valid, SFPUC will start the interconnection review process.
- b. Initial Review. Upon receipt of a complete and valid Application and plans, SFPUC shall perform an Initial Review. The Initial Review determines if (i) the Generating Facility qualifies for a Simplified

Interconnection, or (ii) the Generating Facility requires a Detailed Review. Absent extraordinary circumstances, SFPUC shall notify Applicant in writing of the results of Initial Review within fifteen (15) Business Days following validation of an Interconnection Application.

- i.** Passage of Initial Review. For Interconnection Applications that pass the Initial Review and do not require Detailed Review, SFPUC will provide the Applicant with a Generator Interconnection Agreement or Generator Interconnection Agreement and Net Energy Metering Agreement, if applicable, within fifteen (15) Business Days of providing notice of Initial Review results. All dates and timelines are contingent on a complete Interconnection Application submittal from the customer, and timely responses to information requests. For Interconnection Applications that pass the Initial Review but also require a Detailed Review, SFPUC will provide Applicant with a non-binding cost estimate of the Advanced Engineering Fee once the Initial Review is completed. These facilities may be treated as Special Facilities (depending on circumstance) for the purpose of determining Applicant costs. The applicant can then proceed with executing an Interconnection Agreement in accordance with Section C.2.d below.
- ii.** Failure of Initial Review. For Interconnection Applications that fail Initial Review, SFPUC will provide the technical reason, data and analysis supporting the Initial Review results in writing and provide Applicant the option to proceed directly to a Detailed Review. The Applicant shall notify SFPUC within ten (10) Business Days following such notification whether to (i) proceed to a Detailed Review, or (ii) withdraw the Interconnection Application. Applicants that elect to proceed to a Detail Review shall provide a nonrefundable Advance Engineering Fee with their response. SFPUC will proceed with the Detailed Review once payment of the required Advance Engineering Fee has been received. If Applicant fails to notify SFPUC within ten (10) Business Days of such notification, the Interconnection Application will be deemed withdrawn.
- iii.** Additional Initial Review Information. No changes may be made to the planned Point of Interconnection or Generating Facility size included in the Interconnection Application during the review process unless such changes are agreed to by SFPUC. Where agreement has not been reached, Applicants choosing to change the Point of Interconnection or Generating Facility size

must reapply and submit a new Interconnection Application.

c. Detailed Review.

If Applicant requests a Detailed Review and submits an Advance Engineering Fee, SFPUC will perform the Detailed Review within thirty (30) Business Days, absent extraordinary circumstances, following authorization and receipt of the fee. The Detailed Review will determine if the Generating Facility qualifies for interconnection, or interconnection with additional requirements.

The Applicant must provide the following data to SFPUC when requesting a Detailed Review. Additional information may be required from the Applicant in order for SFPUC to complete system impact and load flow studies.

Generator:

1. MVA Rating
2. kV Rating
3. Base MVA
4. Base kV
5. X_d'' (direct axis subtransient reactance)
6. X_d' (direct axis transient reactance)
7. X_d (Synchronous reactance)
8. X_2 (Negative Sequence reactance)
9. X_0 (Zero Sequence reactance)

Generating Facility Transformer Data:

1. Winding configuration (delta-Wye gnd or Wye gnd-Delta)
2. MVA Rating
3. KV Rating
4. Base MVA
5. Base KV
6. Z_1 HV-LV
7. Z_0 HV-LV

Line Data:

1. Impedance data for line from Transformer to POI (if applicable)
2. Z_1
3. Z_0
4. Point of Interconnection (POI) Location

- i.** Passage of Detailed Review. For Interconnection Applications that pass a Detailed Review and do not require Interconnection Facilities or Distribution Upgrades, SFPUC will provide Applicant with a Generator Interconnection Agreement within

fifteen (15) Business Days of providing notice of the Detailed Review results. For Interconnection Applications that pass a Detailed Review but also require Interconnection Facilities or Distribution upgrades, SFPUC will provide Applicant with a non-binding cost estimate of the Interconnection Facilities or Distribution upgrades within thirty (30) Business Days of providing notice of the Detailed Review results. These facilities may be treated as Special Facilities (depending on circumstance) for the purpose of determining Applicant costs. The Applicant can then proceed with executing an Interconnection Agreement in accordance with Section C.2.d below.

- ii.** Failure of Detailed Review. For Interconnection Applications that fail a Detailed Review, SFPUC will provide the technical reason, data, and analysis supporting the Detailed Review results in writing and provide Applicant the option to amend their initial application. The Applicant shall notify SFPUC within fifteen (15) Business Days following such notification whether to (i) amend and re-submit their Interconnection Application, or (ii) withdraw the Interconnection Application. If Applicant fails to notify SFPUC within fifteen (15) Business Days of such notification, the Interconnection Application shall be deemed withdrawn.

d. Execution of the Generator Interconnection Agreement.

- i.** Following the receipt of a cost estimate for any Distribution Upgrades and/or Interconnection Facilities that have been identified (Applicants that did not require a cost estimate may proceed to Section C.2.d.ii below), Applicant shall notify SFPUC within fifteen (15) Business Days whether Applicant: (i) requests a Generator Interconnection Agreement, or (ii) withdraws its Interconnection Application. If Applicant fails to notify SFPUC within fifteen (15) Business Days, then the Interconnection Application shall be deemed withdrawn. If Applicant elects to proceed to a Generator Interconnection Agreement, then SFPUC will provide Applicant with a Generator Interconnection Agreement for Applicant's signature within fifteen (15) Business Days of Applicant's request.
- ii.** Upon receipt of a draft Generator Interconnection Agreement, Applicant has ninety (90) Calendar Days to sign and return the

Generator Interconnection Agreement. Applicant shall provide to SFPUC written comments, or notification of a lack of any comments, on the draft Generator Interconnection Agreement and appendices within thirty (30) Calendar Days. At the request of Applicant, SFPUC shall begin negotiations with Applicant at any time after SFPUC provides Applicant with the draft Generator Interconnection Agreement, which contains in its appendices the cost estimate for any Distribution Upgrades and/or Interconnection Facilities that have been identified by SFPUC. If Applicant fails to execute the Generator Interconnection Agreement within the ninety (90) Calendar Days described in this section, the Interconnection Application shall be deemed withdrawn.

- iii. After Applicant has executed the Generator Interconnection Agreement and paid the final invoice for estimated cost of Distribution Upgrades and/or Interconnection Facilities, SFPUC will commence with the design, procurement, construction, and installation of required facilities identified in the Generator Interconnection Agreement. Once the Applicant executes the Agreement, the Applicant is thereafter referred to as a Producer. SFPUC and Producer will use good faith efforts to meet schedules and estimated costs in accordance with the requirements of the Generator Interconnection Agreement. Producer is responsible for all costs associated with Parallel Operation to support the safe and reliable operation of the Distribution System and Transmission System.

3. COMMISSIONING TESTING AND PARALLEL OPERATION

- a. Commissioning Testing. Producer is responsible for commissioning and testing new Generating Facilities and associated Interconnection Facilities to ensure compliance with the safety and reliability provisions of this Rule prior to being operated in parallel with SFPUC's Distribution or Transmission System. For non-Certified Equipment, Producer shall develop a written testing plan to be submitted to SFPUC for its review and acceptance. Where applicable, the testing plan shall include the installation test procedures published by the manufacturer of the Generating Facility or Interconnection Facilities. Facility testing shall be conducted at a mutually agreeable time, and SFPUC shall be given the opportunity to witness the tests.
- b. Parallel Operation or Momentary Parallel Operation. Producer shall not commence Parallel Operation of its Generating Facility with SFPUC's system unless it has received SFPUC's express written

permission to do so. SFPUC will authorize Producer's Generating Facility for Parallel Operation or momentary Parallel Operation with SFPUC's Distribution or Transmission System, in writing, within five (5) Calendar Days of satisfactory compliance with the terms of all applicable agreements.

4. WITHDRAWAL / CANCELLATION

Applicant may withdraw its Interconnection Application at any time by written notice of such withdrawal to SFPUC. In addition, after receipt of the Interconnection Application, if Applicant fails to adhere to the requirements and timelines of this rule, then SFPUC shall deem the Interconnection Application to be withdrawn and shall provide written notice to Applicant of the deemed withdrawal within five (5) Business Days and an explanation of the reasons for such deemed withdrawal. Upon receipt of such written notice, Applicant shall have five (5) Business Days in which to either respond with information or action that either cures the deficiency or supports its position that the deemed withdrawal was erroneous.

Applications that are over one year old (from the date of SFPUC's receipt) without resulting in a signed Interconnection Agreement within one year of completion of all applicable review and/or studies, are subject to cancellation by SFPUC.

D. GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS

This section D. is consistent with the requirements of ANSI/IEEE 1547-2003 *Standard for Interconnecting Distributed Resources with Electric Power Systems* (IEEE 1547). Exceptions are taken to IEEE 1547 Clauses 4.1.4.2 Distribution Secondary Spot Networks and Clauses 4.1.8.1 or 5.1.3.1, which address Protection from Electromagnetic Interference. Note that this Rule and Regulation 27 does not adopt the Generating Facility power limitation of 10 MW incorporated in IEEE 1547.

Additional limitations may apply based upon distribution system or interconnected third party utility requirements.

1. GENERAL INTERCONNECTION AND PROTECTION FUNCTION REQUIREMENTS

The Protective Functions and requirements of this Rule are designed to protect SFPUC's Distribution System and not the Generating Facility. Customer shall be solely responsible for providing adequate protection for its Generating Facility and Interconnection Facilities. The Customer's Protective Functions

shall not impact the operation of other Protective Functions utilized on SFPUC's Distribution System in a manner that would affect SFPUC's capability of providing reliable service to its Customers.

- a.** Protective Functions Required. A Generating Facility operating in parallel with SFPUC's Distribution System shall be equipped with the following Protective Functions to sense abnormal conditions on SFPUC's Distribution System and cause the Generating Facility to be automatically disconnected from SFPUC's Distribution System or to prevent the Generating Facility from being connected to SFPUC's Distribution System inappropriately:
 - i.** Over and under voltage trip functions and over and under frequency trip functions;
 - ii.** A voltage and frequency sensing and time-delay Function to prevent the Generating Facility from energizing a de-energized Distribution System circuit and to prevent the Generating Facility from reconnecting with SFPUC's Distribution System unless SFPUC's Distribution System service voltage and frequency is within the ANSI C84.1-1995 Table 1 Range B Voltage Range of 106V to 127V on a 120V basis, inclusive, and a frequency range of 59.3 Hz to 60.5 Hz, inclusive, and are stable for at least 60 seconds, and;
 - iii.** A Function to prevent the Generating Facility from contributing to the formation of an Unintended Island and cease to energize the SFPUC system within two seconds of the formation of an Unintended Island. The Generating Facility shall cease to energize SFPUC's Distribution System for faults on SFPUC's Distribution System circuit to which it is connected (IEEE 1547-4.2.1). The Generating Facility shall cease to energize SFPUC's Distribution circuit prior to re-closure by SFPUC's Distribution System equipment (IEEE 1547-4.2.2).
- b.** Momentary Paralleling Generating Facilities. With SFPUC's approval, a transfer switch or scheme used to transfer the Producer's Loads from SFPUC's Distribution System to Producer's Generating Facility may be used in lieu of the Protective Functions required for Parallel Operation.
- c.** 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. Producer'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 SFPUC's Distribution System.

The Generating Facility's paralleling-device shall be capable of withstanding 220% of the Interconnection Facilities' rated voltage (IEEE 1547-4.1.8.3). The Interconnection Facilities shall have the capability to withstand voltage and current surges in accordance with the environments defined in IEEE Std C62.41.2-2002 or IEEE Std C37.90.1-2002 as applicable and as described in IEEE 1547-4.1.8.2.

- d.** Visible Disconnect Required: The Producer shall furnish and install a ganged, manually operated isolating switch (or a comparable device mutually agreed upon by SFPUC and the Producer) near the Point of Interconnection to isolate the Generating Facility from SFPUC's Distribution System. The device does not have to provide overcurrent protection.

The device must:

- i.** Allow visible verification that separation has been accomplished. (This requirement may be met by opening the enclosure to observe contact separation.) Molded case circuit breakers do not meet the visible contact requirement and are not acceptable as a Visible Disconnect device.
- ii.** Include markings or signage that clearly indicates open and closed positions.
- iii.** Be capable of being reached quickly and conveniently 24 hours a day by SFPUC personnel for construction, maintenance, inspection, testing or reading, without obstacles or requiring those seeking access to obtain keys, special permission, or security clearances.
- iv.** Be capable of being locked in the open position.
- v.** Be clearly marked on the submitted Single Line Diagram and its type and location approved by SFPUC prior to installation. If the device is not adjacent to the Point of Common Coupling (PCC), permanent signage must be installed at a SFPUC-approved location providing a clear description of the location of the device. Generating Facilities with Non-Islanding inverters totaling one (1) kilovolt-ampere (kVA) or less are

exempt from this requirement.

- e. Drawings Required. Prior to Parallel Operation or Momentary Parallel Operation of the Generating Facility, SFPUC shall approve the Producer's Protective Function and control diagrams. A Generating Facility equipped with a Protective Function and control scheme previously approved by SFPUC for system-wide application or only Certified Equipment may satisfy this requirement by reference to previously approved drawings and diagrams.
- f. Generating Facility Conditions Not Identified. In the event this Rule does not address the Interconnection conditions for a particular Generating Facility, SFPUC and Producer may agree upon other arrangements, to be approved by SFPUC.

2. PREVENTION OF INTERFERENCE

The Producer shall not operate a Generating Facility or Interconnection Facilities that superimpose a voltage or current upon SFPUC's Distribution System that interferes with SFPUC operations, service to SFPUC Customers, or communication facilities. If such interference occurs, the Producer must diligently pursue and take corrective action at its own expense after being given notice and reasonable time to do so by SFPUC. If the Producer does not take corrective action in a timely manner, or continues to operate the facilities causing interference without restriction or limit, SFPUC may, without liability, disconnect the Producer's facilities from SFPUC's Distribution System, in accordance with Section B.8 of this Rule. To eliminate undesirable interference caused by its operation, each Generating Facility shall meet the following criteria:

- a. Voltage Regulation. The Generating Facility shall not actively regulate the voltage at the PCC while in parallel with SFPUC's Distribution System. The Generating Facility shall not cause the service voltage at other Customers to go outside the requirements of ANSI C84.1-1995, Range A (IEEE 1547-4.1.1).
- b. Operating Voltage Range. The voltage ranges in Table D.1 define protective trip limits for the Protective Function and are not intended to define or imply a voltage regulation Function. A Generating Facility shall cease to energize SFPUC's Distribution System within the prescribed trip time whenever the voltage at the PCC deviates from the allowable voltage operating range. The Protective Function shall detect and respond to voltage on all phases to which the Generating Facility is connected.

- i. **Generating Facilities.** Generating Facilities shall be capable of operating within the voltage range normally experienced on SFPUC’s Distribution System from plus to minus 5% of the nominal voltage (e.g. 114 volts to 126 volts on a 120 volt base), at the service panel or PCC. The trip settings at the generator terminals shall be selected in a manner that minimizes nuisance tripping between 106 volts and 132 volts on a 120-volt base (88-110% of nominal voltage) to compensate for voltage drop between the generator terminals and the PCC. Voltage shall be detected at either the PCC or the Point of Interconnection. However, the voltage range at the PCC with the generator on-line shall stay within +/-5% of nominal.

- ii. **Voltage Disturbances.** Whenever SFPUC’s Distribution System voltage at the PCC varies from and remains outside normal (nominally 120 volts) by the predetermined amounts set forth in Table D.1, the Generating Facility’s Protective Functions shall cause the Generator(s) to become isolated from SFPUC’s Distribution System.

| TABLE D.1: Voltage Trip Settings | | | |
|--|---|---|--------------|
| Voltage at Point of Common Coupling | | Maximum Trip Time⁽¹⁾ | |
| Assuming 120 V Base | % of Nominal Voltage | # of Cycles (Assuming 60 Hz Nominal) | Seconds |
| Less than 60 Volts | Less than 50% | 10 Cycles | 0.16 Seconds |
| Greater than or equal to 60 Volts but less than 106 Volts | Greater than or equal to 50% but less than 88% | 120 Cycles | 2 Seconds |
| Greater than or equal to 106 Volts but less than or equal to 132 Volts | Greater than or equal to 88% but less than or equal to 110% | Normal Operation | |
| Greater than 132 Volts but less than or equal to 144 Volts | Greater than 110% but less than or equal to 120% | 60 Cycles | 1 Second |
| Greater than 144 Volts | Greater than 120% | 10 Cycles | 0.16 Seconds |

⁽¹⁾ “Maximum Trip time” refers to the time between the onset of the abnormal condition and the Generating Facility ceasing to energize SFPUC’s Distribution System. Protective Function sensing equipment and circuits may remain connected to SFPUC’s Distribution System to allow sensing of electrical conditions for use by the “reconnect” feature. The purpose of the allowed time delay is to allow a Generating Facility to “ride through” short-term disturbances to avoid nuisance tripping. Set points shall not be user adjustable (though they may be field adjustable by qualified personnel).

- c. Paralleling. The Generating Facility shall parallel with SFPUC’s Distribution System without causing a voltage fluctuation at the PCC greater than $\pm 5\%$ of the prevailing voltage level of SFPUC’s Distribution System at the PCC, and meet the flicker requirements of D.2.d.
- d. Flicker. The Generating Facility shall not create objectionable flicker for other Customers on SFPUC’s Distribution System. To minimize the adverse voltage effects experienced by other Customers (IEEE 1547-4.3.2), flicker at the PCC caused by the Generating Facility should not exceed the limits defined by the “Maximum Borderline of Irritation Curve” identified in IEEE 519-1992 (IEEE Recommended Practices and Requirements for Harmonic Control in Electric Power Systems, IEEE STD 519-1992). This requirement is necessary to minimize the adverse voltage affects experienced by other Customers on SFPUC’s Distribution System. Generators may be connected and brought up to synchronous speed (as an induction motor) provided these flicker limits are not exceeded.
- e. Integration with SFPUC’s Distribution System Grounding. The grounding scheme of the Generating Facility shall not cause over-voltages that exceed the rating of the equipment connected to SFPUC’s Distribution System and shall not disrupt the coordination of the ground fault protection on SFPUC’s Distribution System (IEEE 1547-4.1.2).
- f. Frequency. The Generating Facility shall operate in synchronism with SFPUC’s Distribution System. Whenever SFPUC’s Distribution System Frequency at the PCC varies from and remains outside normal (nominally 60 Hz) by the predetermined amounts set forth in Table D.2, the Generating Facility’s Protective Functions shall cease to energize SFPUC’s Distribution System within the stated maximum trip time.

TABLE D.2: Frequency Trip Settings

| Generating Facility Rating | Frequency Range (Assuming 60 Hz Nominal) | Maximum Trip Time ⁽¹⁾ (Assuming 60 Cycles per Second) |
|-----------------------------------|---|---|
| Less or equal to 15 kW | Less than 59.3 Hz | 10 Cycles |
| | Greater than 60.5 Hz | 10 Cycles |
| Greater than 15 kW | Less than 57 Hz | 10 Cycles |
| | Less than an adjustable value between 59.8 Hz and 57 Hz but greater than 57 Hz ⁽²⁾ | Adjustable between 10 and 18,000 Cycles ^{(2),(3)} |

| | | |
|--|----------------------|-----------|
| | Greater than 60.5 Hz | 10 Cycles |
|--|----------------------|-----------|

- (1) “Maximum Trip time” refers to the time between the onset of the abnormal condition and the Generating Facility ceasing to energize SFPUC’s Distribution System. Protective Function sensing equipment and circuits may remain connected to SFPUC’s Distribution System to allow sensing of electrical conditions for use by the “reconnect” feature. The purpose of the allowed time delay is to allow a Generating Facility to “ride through” short-term disturbances to avoid nuisance tripping. Set points shall not be user adjustable (though they may be field adjustable by qualified personnel).
- (2) Unless otherwise required by SFPUC, a trip frequency of 59.3 Hz and a maximum trip time of 10 cycles shall be used.
- (3) When a 10-cycle maximum trip time is used, a second under frequency trip setting is not required.

g. Harmonics. When the Generating Facility is serving balanced linear Loads, harmonic current injection into SFPUC’s Distribution System at the PCC shall not exceed the limits stated below in Table D.3. The harmonic current injections shall be exclusive of any harmonic currents due to harmonic voltage distortion present in SFPUC’s Distribution System without the Generating Facility connected (IEEE 1547-4.3.3). The harmonic distortion of a Generating Facility located at a Customer’s site shall be evaluated using the same criteria as for the Host Loads.

| Table D.3 Maximum Harmonic Current Distortion in Percent of Current (I)^(1,2) | | | | | | |
|--|------|-------------|-------------|-------------|--------|-------------------------------|
| Individual Harmonic Order h, (odd harmonics) ⁽³⁾ | h<11 | 11 ≤ h < 17 | 17 ≤ h < 23 | 23 ≤ h < 35 | 35 ≤ h | Total Demand distortion (TDD) |
| Max Distortion (%) | 4.0 | 2.0 | 1.5 | 0.6 | 0.3 | 5.0 |

- (1) IEEE 1547-4.3.3
- (2) I = the greater of the maximum Host Load current average Demand over 15 or 30 minutes without the GF, or the GF rated current capacity (transformed to the PCC when a transformer exists between the GF and the PCC).
- (3) Even harmonics are limited to 25% of the odd harmonic limits above.

h. Direct Current Injection. Generating Facilities should not inject direct current greater than 0.5% of rated output current into SFPUC’s Distribution System.

i. Power Factor. Each Generator in a Generating Facility shall be capable of operating at some point within a Power Factor range from 0.9 leading to 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 the Host Loads or that reactive power is otherwise provided under tariff by SFPUC. The Producer shall notify SFPUC if it is using the Generating Facility for Power Factor correction. Unless otherwise agreed upon by the Producer and SFPUC, Generating Facilities shall automatically regulate Power Factor, not voltage, while operating in parallel with SFPUC's Distribution System.

3. TECHNOLOGY SPECIFIC REQUIREMENTS

- a.** Three-Phase Synchronous Generators. For three-phase Generators, the Generating Facility circuit breakers shall be three-phase devices with electronic or electromechanical control. The Producer shall be responsible for properly synchronizing its Generating Facility with SFPUC's Distribution System by means of either manual or automatic synchronizing equipment. Automatic synchronizing is required for all synchronous Generators that have a Short Circuit Contribution Ratio (SCCR) exceeding 0.05. Loss of synchronism protection is not required except as may be necessary to meet D.2.d (Flicker) (IEEE 1547-4.2.5). Unless otherwise agreed upon by the Producer and SFPUC, synchronous Generators shall automatically regulate Power Factor, not voltage, while operating in parallel with SFPUC's Distribution System. A power system stabilization function is specifically not required for Generating Facilities under 10 MW Net Nameplate Rating. Ground Fault Protection is required for generators ≥ 40 kW. Voltage Restraint Overcurrent or Voltage Controlled Overcurrent relays are required for generators or a group of generators ≥ 400 kW.
- b.** Induction Generators. Induction Generators (except self-excited Induction Generators) do not require a synchronizing Function. Starting or rapid Load fluctuations on induction Generators can adversely impact SFPUC's Distribution System's voltage. Corrective step-switched capacitors or other techniques may be necessary and may cause undesirable ferroresonance. When these counter measures (e.g. additional capacitors) are installed on the Producer's side of the Point of Common Coupling, SFPUC must review these measures. Additional equipment may be required as determined in a Detailed Review or a Detailed Study. Ground Fault Protection is required for generators ≥ 40 kW. Voltage Restraint Overcurrent or Voltage Controlled Overcurrent relays are required for generators or a group of generators ≥ 400 kW.
- c.** Inverters. Only California Energy Commission certified inverters are approved for interconnection. Utility- interactive inverters do not require separate synchronizing equipment. Non-utility- interactive or

“stand-alone” inverters shall not be used for Parallel Operation with SFPUC’s Distribution System. Inverters or a group of inverters \geq 400 kW require Ground Fault Protection.

- d. 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 connected to a center-tapped service neutral must be installed such that no more than 6 kVA of unbalanced power is applied to the two “legs” of the service. The current in the most heavily loaded leg must not exceed twice that of the other leg. For Dedicated Distribution Transformer Services, the maximum Net Nameplate Rating of a single-phase Generating Facility shall be the transformer nameplate rating.

4. SUPPLEMENTAL GENERATING FACILITY REQUIREMENTS

- a. Fault Detection. A Generating Facility with an SCCR exceeding 0.1 or one that does not cease to energize SFPUC’s Distribution System within two seconds of the formation of an Unintended Island shall be equipped with Protective Functions designed to detect Distribution System faults, both line-to-line and line-to-ground, and shall cease to energize SFPUC’s Distribution System within two seconds of the initiation of a fault.
- b. Transfer Trip. For a Generating Facility that cannot detect Distribution System faults (both line-to-line and line-to-ground) or the formation of an Unintended Island, and cease to energize SFPUC’s Distribution System within two seconds, SFPUC may require a Transfer Trip system or an equivalent Protective Function. For net metered or non-net metered Generating Facilities, the Facility will be considered capable of supporting an Unintended Island if the aggregate distributed generation output is 80% or more of the Distribution System real-time load kW seen at SFPUC’s source-side Distribution Protection Device.
- c. Reclose Blocking. Where the aggregate Generating Facility capacity exceeds 15% of the peak Load on any automatic reclosing device, SFPUC may require additional Protective Functions, including, but not limited to reclose-blocking on some of the automatic reclosing devices.

5. SMART INVERTER GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS

The inverter requirements are intended to be consistent with ANSI/IEEE 1547-2003 and 1547a Standard for Interconnecting Distributed Resources with

Electric Power Systems (IEEE 1547 including amendment 1547a). Exceptions are taken to IEEE 1547 Clauses 4.1.4.2 Distribution Secondary Spot Networks and Clauses 4.1.8.1 or 5.1.3.1, which address Protection from Electromagnetic Interference. Rule 27 does not adopt the Generating Facility power limitation of 10 MW incorporated in IEEE1547.

a. Protective Functions Required. Smart Inverters operating in parallel with SFPUC's Distribution System shall be equipped with the following Protective Functions to sense abnormal conditions on SFPUC's Distribution System and cause the Smart Inverter to be automatically disconnected from SFPUC's Distribution System or to prevent the Smart Inverter from being connected to SFPUC's Distribution System inappropriately:

- i.** Over and under voltage trip functions and over and under frequency trip functions;
- ii.** A voltage and frequency sensing and time-delay function to prevent the Smart Inverter from energizing a de-energized Distribution System circuit and to prevent the Smart Inverter from reconnecting with SFPUC's System unless SFPUC's Distribution System service voltage and frequency is within the ANSI C84.1-1995 Table 1 Range B voltage Range of 106 volts to 127 volts (on a 120 volt basis), inclusive, and a frequency range of 59.3 Hz to 60.5 Hz, inclusive, and are stable for at least 15 seconds; and
- iii.** A function to prevent the Smart Inverter from contributing to the formation of an Unintended Island, and cease to energize SFPUC's Distribution System within two seconds of the formation of an Unintended Island.
- iv.** Only Certified Smart Inverters are approved for interconnection. Smart Inverters or a group of Smart Inverters \geq 400 kW require Ground Fault Protection.

The Smart Inverter shall cease to energize SFPUC's Distribution System for faults on SFPUC's Distribution System circuit to which it is connected (IEEE 1547-4.2.1). The Smart Inverter shall cease to energize SFPUC's Distribution circuit prior to reclosing by SFPUC's Distribution System equipment (IEEE 1547-4.2.2).

b. Momentary Paralleling Generating Facilities. With SFPUC's approval, the transfer switch or scheme used to transfer Producer's loads from

SFPUC's Distribution System to Producer's Generating Facility may be used in lieu of the Protective Functions required for Parallel Operation.

- c.** Suitable Equipment Required. Circuit breakers or other interrupting equipment located at the PCC 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. Producer's Smart Inverter and Interconnection Facilities shall be designed so that the failure of any single device or component shall not potentially compromise the safety and reliability of SFPUC's Distribution System. The Smart Inverter paralleling-device shall be capable of withstanding 220% of the Interconnection Facility rated voltage (IEEE 1547- 4.1.8.3). The Interconnection Facility shall have the capability to withstand voltage and current surges in accordance with the environments defined in IEEE Std. C62.41.2-2002 or IEEE Std. C37.90.1-2002 as applicable and as described in L.3.e (IEEE 1547-4.1.8.2).
- d.** Visible Disconnect Required. Producer shall furnish and install a ganged, manually- operated isolating switch (or a comparable device mutually agreed upon by SFPUC and Producer) near the Point of Common Coupling to isolate the Smart Inverter from SFPUC's Distribution System. The device does not have to provide over-current protection.

The device must:

- i.** Allow visible verification that separation has been accomplished. (This requirement may be met by opening the enclosure to observe contact separation.) Molded case circuit breakers do not meet the visible contact requirement and are not acceptable as a Visible Disconnect device.
- ii.** Include markings or signage that clearly indicates open and closed positions.
- iii.** Be capable of being reached quickly and conveniently 24 hours a day by SFPUC personnel for construction, maintenance, inspection, testing or reading, without obstacles or requiring those seeking access to obtain keys, special permission, or security clearances.
- iv.** Be capable of being locked in the open position.

- v. Be clearly marked on the submitted single line diagram and its type and location approved by SFPUC prior to installation. If the device is not adjacent to the PCC, permanent signage must be installed at a SFPUC approved location providing a clear description of the location of the device. If the switch is not accessible outside the locked premises, signage with contact information and a SFPUC approved locking device for the premises shall be installed. Generating Facilities with Non-Islanding inverters totaling one (1) kilovolt-ampere (kVA) or less are exempt from this requirement.

- e. Drawings Required. Prior to Parallel Operation or Momentary Parallel Operation of the Smart Inverter, SFPUC shall approve Producer's Protective Function and control diagrams. Generating Facilities equipped with Protective Functions and a control scheme previously approved by SFPUC for system-wide application or only Certified Equipment may satisfy this requirement by reference to previously approved drawings and diagrams.

- f. Generating Facility Conditions Not Identified. In the event this Rule does not address the Interconnection conditions for a particular Smart Inverter, SFPUC and Producer may agree upon other arrangements, to be approved by SFPUC.

- g. Prevention of Interference. Producer shall not operate Smart Inverters that superimpose a voltage or current upon SFPUC's Distribution System that interferes with SFPUC operations, service to SFPUC Customers or communication facilities. If such interference occurs, Producer must diligently pursue and take corrective action at its own expense after being given notice and reasonable time to do so by SFPUC. If Producer does not take corrective action in a timely manner, or continues to operate the facilities causing interference without restriction or limit, SFPUC may, without liability, disconnect Producer's facilities from SFPUC's Distribution System, in accordance with Section B.8 of this Rule.

- h. Voltage Regulation. If approved by SFPUC, the Smart Inverter may actively regulate the voltage at the Point of Common Coupling (PCC) while in parallel with SFPUC's Distribution System. The Smart Inverter shall not cause the service voltage at other customers to go outside the requirements of ANSI C84.1-1995, Range A (IEEE 1547-4.1.1).

- i. Voltage Trip and Ride-Through Settings. The voltage ranges in Table D.4 define protective trip limits for the Protective Function and are not intended to define or imply a voltage regulation Function.

Generating Facilities shall cease to energize SFPUC's Distribution System within the prescribed trip time whenever the voltage at the PCC deviates from the allowable voltage operating range. The Protection Function shall detect and respond to voltage on all phases to which the Generating Facility is connected.

- j.** Smart Inverters. Smart Inverters shall be capable of operating within the voltage range normally experienced on SFPUC's Distribution System from plus to minus 5% of the nominal voltage (e.g. 114 volts to 126 volts, on a 120 volt base), at the service panel or PCC. The trip settings at the generator terminals may be selected in a manner that minimizes nuisance tripping in accordance with Table D.4 to compensate for voltage drop between the generator terminals and the PCC. Voltage may be detected at either the PCC or the Point of Interconnection. However, the voltage range at the PCC, with the generator on-line, shall stay within +/-5% of nominal.
- k.** Voltage Disturbances. Whenever SFPUC's Distribution System voltage at the PCC varies from and remains outside Near Nominal voltage for the predetermined parameters set forth in Table D.4, the Smart Inverter's Protective Functions shall cause the Smart Inverter(s) to become isolated from SFPUC's Distribution System:

 - i.** The Smart Inverter shall stay connected to SFPUC's Distribution System while the grid remains within the "Ride-Through Until" voltage-time range and must stay connected in the corresponding "Operating Mode".
 - ii.** For voltage excursions beyond the near Nominal (NN) magnitude range and within the range of the HV1 or LV3 regions, the Smart Inverter shall momentarily cease to energize within 0.16 seconds.
 - iii.** In the HV1 region, the Smart Inverter is permitted to reduce power output as a function of voltage under mutual agreement between the Producer and SFPUC.
 - iv.** If the distribution system voltage does not exit the ride-through region and recovers to normal system voltage, the Smart Inverter shall restore continuous operation within 2 seconds.
 - v.** If the SFPUC's Distribution System voltage does not exit the ride-through region and returns from the LV3 region to the LV2 or LV1 region, the Smart Inverter shall restore available current within 2 seconds.

- vi. Different voltage-time settings could be permitted by SFPUC.

| Table D.4: Voltage Ride-Through Table | | | | |
|--|--|---------------------------|-----------------------|--------------------------|
| Region | Voltage at Point of Common Coupling (% Nominal Volts) | Ride-Through Until | Operating Mode | Maximum Trip Time |
| High Voltage 2 (HV2) | $V \geq 120$ | | | 0.16 seconds |
| High Voltage 1 (HV1) | $110 < V < 120$ | 12 seconds | Momentary Cessation | 13 seconds |
| Near Nominal (NN) | $88 \leq V \leq 110$ | Indefinite | Continuous Operation | Not Applicable |
| Low Voltage 1 (LV1) | $70 \leq V < 88$ | 20 seconds | Mandatory Operation | 21 seconds |
| Low Voltage 2 (LV2) | $50 \leq V < 70$ | 10 seconds | Mandatory Operation | 11 seconds |
| Low Voltage 3 (LV3) | $V < 50$ | 1 second | Momentary Cessation | 1.5 seconds |

- i. Paralleling. The Generating Facility shall parallel with SFPUC's Distribution System without causing a voltage fluctuation at the PCC greater than plus/minus 5% of the prevailing voltage level of SFPUC's Distribution System at the PCC, and meet the flicker requirements of Section D.5.m below.
- m. Flicker. The Generating Facility shall not create objectionable flicker for other customers on SFPUC's Distribution System. To minimize the adverse voltage effects experienced by other customers (IEEE 1547-4.3.2), flicker at the PCC caused by the Generating Facility should not exceed the limits defined by the "Maximum Borderline of Irritation Curve" identified in IEEE 519-1992 (IEEE Recommended Practices and Requirements for Harmonic Control in Electric Power Systems, IEEE STD 519-1992). This requirement is necessary to minimize the adverse voltage affects experienced by other Customers on SFPUC's Distribution System. Generators may be connected and brought up to synchronous speed (as an induction motor) provided these flicker limits are not exceeded.
- n. Integration with SFPUC's Distribution System Grounding. The grounding scheme of the Generating Facility shall not cause over-

voltages that exceed the rating of the equipment connected to SFPUC’s Distribution System and shall not disrupt the coordination of the ground fault protection on SFPUC’s Distribution System (IEEE 1547-4.1.2).

- o.** Frequency. SFPUC controls system frequency, and the Generating Facility shall operate in synchronism with SFPUC’s Distribution System. Whenever SFPUC’s Distribution System frequency at the PCC varies from and remains outside normal (nominally 60 Hz) by the predetermined amounts set forth in Table D.2, the Generating Facility’s Protective Functions shall cease to energize SFPUC’s Distribution System within the stated maximum trip time.

- p.** Frequency Ride-Through Requirements. Smart Inverter based systems shall remain connected to SFPUC’s Distribution System while the grid is within the frequency-time range indicated in Table D.5, and shall disconnect from the electric grid during a high or low frequency event that is outside that frequency-time range. The frequency values are shown in Table D.5. These values provide default interconnection system response to abnormal frequencies. The inverter shall disconnect by the default clearing times. In the high frequency range between 60.2 Hz and 61.5 Hz, or some other mutually agreed range, the Smart Inverter is permitted to reduce real power output until it ceases to export power by 61.5 Hz, or other frequency value mutually agreed between the generating facility operator and SFPUC. Islands and microgrids may need different default frequency settings.

Table D.5: Frequency Ride-Through and Trip Settings Table

| System Frequency Default Settings (Hz) | Minimum Range of Adjustability (Hz) | Ride-Through Until | Ride –Through Operational Mode | Maximum Trip Time |
|---|--|---------------------------|---------------------------------------|--------------------------|
| $f > 62$ | 62 – 64 | No Ride Through | Not Applicable | 0.16 seconds |
| $60.5 < f \leq 62$ | 60.1 – 62 | 299 seconds | Mandatory Operation | 300 seconds |
| $58.5 \leq f \leq 60.5$ | Not Applicable | Indefinite | Continuous Operation | Not Applicable |
| $57.0 \leq f < 58.5$ | 57 – 59.9 | 299 seconds | Mandatory Operation | 300 seconds |
| $f < 57.0$ | 53 – 57 | No Ride Through | Not Applicable | 0.16 seconds |

- q. Harmonics. When the Smart Inverter is serving balanced linear loads, harmonic current injection into SFPUC's Distribution System at the PCC shall not exceed the limits stated in Table D.3. The harmonic current injections shall be exclusive of any harmonic currents due to harmonic voltage distortion present in SFPUC's Distribution System without the Smart Inverter connected (IEEE 1547- 4.3.3.). The harmonic distortion of a Smart Inverter shall be evaluated using the same criteria as for the Host Loads.
- r. Direct Current Injection. Smart Inverter should not inject direct current greater than 0.5% of rated output current into SFPUC's Distribution System.
- s. Power Factor. Producer shall provide adequate reactive power compensation on site to maintain the Smart Inverter power factor near unity at rated output or a SFPUC specified power factor in accordance with the following requirements:
 - i. Default Power Factor setting: 1.0 +/- 0.01 (0.99 Lagging to 0.99 Leading).
 - ii. Aggregate generating facility is greater than 15 kW: 1.0 +/- 0.15 (0.85 Lagging to 0.85 Leading) down to 20% rated power based on available reactive power.
 - iii. Aggregate generating facility is less than or equal to 15 kW: 1.0 +/- 0.10 (0.90 Lagging to 0.90 Leading) down to 20% rated power based on available reactive power.
- t. Dynamic Volt/VAR Operations. The Smart Inverter shall be capable of operating dynamically within a power factor range of +/- 0.85 PF for larger (>15 kW) systems, down to 20% of rated power, and +/- 0.9 PF for smaller systems (\leq 15 kW), down to 20% of rated power, based on available reactive power. This dynamic Volt/VAR capability shall be able to be activated or deactivated in accordance with SFPUC requirements.

SFPUC may permit or require the Smart Inverter systems to operate in larger power factor ranges, including in 4-quadrant operations for storage systems with the implementation of additional anti-islanding protection as determined by SFPUC.

The Smart Inverter shall be capable of providing dynamic reactive

power compensation (dynamic Volt/VAR operation) within the following constraints:

- The Smart Inverter shall not cause the line voltage at the point of common coupling to go outside the requirements of the latest version of ANSIC84.1, Range A.
 - The Smart Inverter shall be able to consume reactive power in response to an increase in line voltage, and produce reactive power in response to a decrease in line voltage.
 - The reactive power provided shall be based on available reactive power, but the maximum reactive power provided to the system shall be as directed by SFPUC.
- u.** Ramp Rate Requirements. The Smart Inverter is required to have the following ramp controls for at least the following two conditions. These functions can be established by multiple control functions or by one general ramp rate control function. Ramp rates are contingent upon sufficient energy available from the Smart Inverter
- Normal ramp-up rate: For transitions between energy output levels over the normal course of operation. The default value is 100% of maximum current output per second with a range of adjustment between 1% to 100%, with specific settings as mutually agreed by the SFPUC and the Producer.
 - Connect/Reconnect Ramp-up rate: Upon starting to inject power into the grid, following a period of inactivity or a disconnection, the inverter shall be able to control its rate of increase of power from 1 to 100% maximum current per second, with specific settings as mutually agreed upon by SFPUC and the Producer.
- v.** Default Activation States for Phase 1 Functions. Unless otherwise provided by SFPUC, the default settings will be as follows:
- Anti-islanding – activated
 - Low/High Voltage Ride-Through – activated
 - Low/High Frequency Ride-Through – activated
 - Dynamic Volt/VAR operations – deactivated
 - Ramp rates – activated

- Fixed power factor – activated
- Reconnect by “soft-start” methods – activated

These default activation states may be modified by mutual agreement between SFPUC and Producer.

- w. Automatic Transfer (Load Shedding or Transfer). The voltage and frequency ride-through requirements of D.5.i and D.5.m shall not apply if either: a) The real power across the Point of Common Coupling is continuously maintained at a value less than 10% of the aggregate rating of the Smart Inverters connected to the Generation Facility prior to any voltage disturbance, and the Generation Facility disconnects from SFPUC’s distribution system, along with Generation Facility load, such that the net change in real power flow from or to SFPUC is less than 10% of the aggregate Smart Inverter capacity; or b) Generation Facility load real power demand equal to 90% to 120% of the pre-disturbance aggregate Smart Inverter real power output is shed within 0.1 seconds of Smart Inverter disconnection.
- x. Fault Detection. A Smart Inverter with an SCCR exceeding 0.1 or one that does not cease to energize SFPUC’s Distribution System within two seconds of the formation of an Unintended Island shall be equipped with Protective Functions designed to detect Distribution System faults, both line-to-line and line-to-ground, and cease to energize SFPUC’s Distribution System within two seconds of the initiation of a fault.
- y. Transfer Trip. For a Generating Facility that cannot detect Distribution System faults (both line-to-line and line-to-ground) or the formation of an Unintended Island, and cease to energize SFPUC’s Distribution System within two seconds, SFPUC may require a Transfer Trip system or an equivalent Protective Function.
- z. Reclose Blocking. Where the aggregate Generating Facility capacity exceeds 15% of the peak load on any automatic reclosing device, SFPUC may require additional Protective Functions, including, but not limited to reclose-blocking on some of the automatic reclosing devices.

E. INTERCONNECTION FACILITIES AND DISTRIBUTION SYSTEM MODIFICATIONS OWNERSHIP AND COST ALLOCATION

1. SCOPE AND OWNERSHIP OF INTERCONNECTION FACILITIES AND DISTRIBUTION SYSTEM MODIFICATIONS

- a. Scope. Parallel Operation of Generating Facilities may require Interconnection Facilities or modifications to SFPUC's Distribution System ("Distribution System modifications"). The type, extent and costs of Interconnection Facilities and Distribution System modifications shall be consistent with this Rule and determined through the Detailed Review and/or Interconnection Studies described in Section C.
- b. Ownership. Interconnection Facilities installed on Producer's side of the PCC may be owned, operated and maintained by the Producer or SFPUC. Interconnection Facilities installed on SFPUC's side of the PCC and Distribution System modifications shall be owned, operated, and maintained only by SFPUC.

2. RESPONSIBILITY OF COSTS OF INTERCONNECTING A GENERATING FACILITY

- a. Study and Review Costs. The Producer shall be responsible for the reasonably incurred costs of the reviews and studies conducted pursuant to Section C.1 of this Rule.
- b. Facility Costs. The Producer shall be responsible for all costs associated with Interconnection Facilities owned by the Producer. The Producer shall also be responsible for any costs reasonably incurred by SFPUC in providing, operating, or maintaining the Interconnection Facilities and Distribution System modifications required for the Interconnection of the Producer's Generating Facility with SFPUC's Distribution System.
- c. Separation of Costs. Should SFPUC combine the installation of Interconnection Facilities or Distribution System modifications required for the Interconnection of a Generating Facility with modifications to SFPUC's Distribution System to serve other Customers or Producers, SFPUC shall not include the costs of such separate or incremental facilities in the amounts billed to the Producer.
- d. Payments. The Producer must pay applicable costs prior to the scheduling of any engineering reviews and studies; construction of distribution system modifications; or interconnection of generating facilities to SFPUC's Distribution System.

3. INSTALLATION AND FINANCING OF INTERCONNECTION FACILITIES AND DISTRIBUTION SYSTEM MODIFICATIONS

- a. Agreement Required. The costs for Interconnection Facilities and

Distribution System modifications shall be paid by the Producer pursuant to the Provisions contained in the Special Facilities Agreement. Where the type and extent of the Interconnection Facilities or Distribution System modifications warrant additional detail, Producer and SFPUC shall execute separate agreement(s) to more fully describe and allocate the parties' responsibilities for installing, owning, operating, and maintaining the Interconnection Facilities and Distribution System modifications.

- b.** Interconnection Facilities and Distribution System Modifications. Interconnection Facilities connected to SFPUC's side of the Point of Common Coupling and Distribution System modifications shall be provided, installed, owned, and maintained by SFPUC at Producer's expense.
- c.** Reservation of Unused Facilities. When a Producer wishes to reserve SFPUC-owned Interconnection Facilities or Distribution System modifications installed and operated as Special Facilities for the Producer at Producer's expense, but idled by a change in the operation of the Producer's Generating Facility or otherwise, Producer may elect to abandon or reserve such facilities consistent with the terms of its agreement with SFPUC. If Producer elects to reserve idle Interconnection Facilities or Distribution System modifications, SFPUC shall be entitled to continue to charge Producer for the costs related to the ongoing operation and maintenance of the Special Facilities.
- d.** Refund of Salvage Value. When a Producer elects to abandon the Special Facilities for which it has either advanced the installed costs or constructed and transferred to SFPUC, the Producer shall not receive a credit for the net salvage value of the Special Facilities.

F. METERING, MONITORING AND TELEMETRY

1. GENERAL REQUIREMENTS

All Generating Facilities shall be metered in accordance with this Section F and shall meet all applicable metering standards of SFPUC's Rules and Regulations.

2. METERING BY SFPUC

The ownership, installation, operation, reading, and testing of revenue Metering Equipment for Generating Facilities shall be by SFPUC only.

3. NET GENERATION METERING

For purposes of monitoring Generating Facility operation to determine standby Charges and applicable non-bypassable Charges as defined in SFPUC's tariffs, and for Distribution System planning and operations, any meter used shall be an SFPUC- owned bi-directional meter.

4. POINT OF COMMON COUPLING METERING

For purposes of assessing SFPUC Charges for retail service, the Producer's PCC Metering shall be reviewed by SFPUC, and if required, replaced to ensure that it will appropriately measure Electric power according to the Provisions of the Customer's Electric Service tariff.

5. TELEMETERING

In very special circumstances telemetering equipment at the Net Generator Metering location may be required at the Producer's expense.

(END)