

A. Background

This Rule is consistent with the technical aspects of the California Public Utility Commission (CPUC) and California Energy Commission's (CEC) Rule 21 Interconnection Rules while supporting District Rates and Rules.

B. Applicability

This Rule describes the interconnection, operating and metering requirements for Generating Facilities to be connected to the District's Distribution System. Subject to the requirements of this Rule, the District will allow the interconnection of Generating Facilities with its Distribution System.

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

C. Definitions

The definitions in this Section C are applicable only to this Rule, the application and Interconnection Agreements.

Active Anti-Islanding Scheme: A control scheme installed as part of the Generating Facility or Interconnection Facilities that senses and prevents the formation of an Unintended Island.

Applicant: The entity submitting an application for interconnection pursuant to this Rule.

Application: A standard form submitted to the District for interconnection of a Generating Facility.

Board: The publicly elected Board of Directors of the Modesto Irrigation District.

Certification Test: A test pursuant to California Public Utility Commission (CPUC) and California Energy Commission's (CEC) Rule 21 that verifies conformance of certain equipment with approved performance standards in order to be classified as certified equipment. Certification tests are performed by a Nationally Recognized Testing Laboratory (NRTL).

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; and
- Establish instrument or protective function set-points.

Customer: The entity or person that receives or is entitled to receive Distribution Service through the Distribution System under the District's Rate Schedules and Rules.

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.

Device: A mechanism or piece of equipment designed to serve a purpose or perform a function. The term may be used interchangeably with the terms "equipment" and "function" without intentional difference in meaning. See also Function and Protective Function.

Distribution Service: All services required by, or provided to, a customer pursuant to the approved Rates and Rules of the District other than services directly related to the interconnection of a Generating Facility under this Rule.

Distribution System: All electrical wires, equipment, and other facilities owned or provided by the District, other than Interconnection Facilities, by which the District provides Distribution Service to its customers.

Electric Utility Service Equipment Requirements Committee (EUSERC): Designation that metering equipment meets the requirements of the member utilities developed to promote safe and uniform electric service equipment requirements.

Emergency: An actual or imminent condition or situation which jeopardizes the District's Distribution System integrity.

Field Testing: Testing performed in the field to determine whether equipment meets the District's requirements for safe and reliable interconnection.

Function: Some combination of hardware and software designed to provide specific features or capabilities. Its use, as in protective function, is intended to encompass a range of implementations from a single-purpose device to a section of software and specific pieces of hardware within a larger piece of equipment to a collection of devices and software.

Generating Facility: All Generators, electrical wires, equipment, and other facilities owned or provided by Producer for the purpose of producing electric power.

Generator: A device converting mechanical, chemical or solar energy into electrical energy, including all of its protective and control functions and structural appurtenances. A Generating Facility comprises one or more Generators.

Gross Nameplate Rating; Gross Rating; Gross Capacity or Gross Nameplate Capacity: The total gross generating capacity of a Generator or Generating Facility as designated by the manufacturer(s) of the generator(s).

Host Load: The electrical power, less the generator auxiliary load, consumed by the customer to which the Generating Facility is connected.

In-rush Current: The maximum, instantaneous input current drawn by an electrical device when first turned on as determined by the In-rush Current test.

Interconnection; Interconnected: The physical connection of a Generating Facility in accordance with the requirements of this Rule so that parallel operation with the District's Distribution System can occur (has occurred).

Interconnection Agreement: An agreement between the District and the Producer providing for the interconnection of a Generating Facility that gives certain rights and obligations to effect or end interconnection. Interconnection Agreements are required for all Generating Facilities.

Interconnection Facilities: The electrical wires, switches and related equipment that are required in addition to the facilities required to provide electric Distribution Service to a customer to allow interconnection. Interconnection Facilities may be located on either side of the point of common coupling as appropriate to their purpose and design. Interconnection Facilities may be integral to a Generating Facility or provided separately. Interconnection Facilities may be owned by either Producer or the District.

Interconnection Request: An applicant's request to interconnect a new Generating Facility, or to increase the capacity of, or change the operating characteristics of, an existing Generating Facility that is interconnected with the District's Distribution System.

Interconnection Study: A study to establish the requirements for interconnection of a Generating Facility with the District's Distribution System following receipt of an application. The study will determine the following: (a) the Generating Facility qualifies for interconnection with the District system with no modifications; or (b) if the Generating Facility requires system modifications to the District System to be able to interconnect.

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

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

Load Carrying Capability: The maximum electrical load that may be carried by a section of the District's Distribution System consistent with reliability and safety under the circumstances being evaluated.

Mandatory Operation: The Smart Inverter operates at maximum available current without tripping during District's Distribution System excursions outside the region of continuous operation. Any functions that protect the Smart Inverter from damage may operate as needed.

Metering: The measurement of electrical power flow in kilowatts (kW) and/or energy in kilowatt-hours (kWh), and, if necessary, reactive power in kVAR at a point, and its display to the District, as required by this Rule.

Metering Equipment: All equipment, hardware, software including meter cabinets, conduit, etc., that are necessary for metering.

Momentary Cessation: The Smart Inverter momentarily reduces current output to the District's Distribution System to below 10% of the maximum continuous output current rating. The Smart Inverter is allowed to increase current output to the District's Distribution System without any intentional reconnection delay once voltage exits the Momentary Cessation region and Permissive Operation region or Continuous Operation region.

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 Rule.

Net Energy Metering: Metering for the receipt and delivery of electricity between the Producer and the District pursuant to the District's Net Energy Metering Rate Schedule.

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

Net Rating; 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).

Network Secondary System; Networked Secondary: An AC distribution system where the secondaries of the distribution transformers are connected to a common bus for supplying electricity directly to consumers. There are two types of secondary networks: Grid Networks (also referred to as area networks or street networks) and Spot Networks. Synonym: Secondary Network. Refer to IEEE 1547.6 for additional detail.

Nominal: Standard frequency and voltage.

Non-Export; Non-Exporting: Designed to prevent the transfer of electrical energy from the Generating Facility to the District's Distribution System.

Non-Islanding: Designed to detect and disconnect from an 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.

Paralleling Device: An electrical device, typically a circuit breaker, operating under the control of a synchronization function or by a qualified operator to connect an energized generator to an energized electric power system or two energized power systems to each other.

Parallel Operation: The simultaneous operation of a generator with power delivered or received by the District while interconnected. For the purpose of this Rule, parallel operation includes only those Generating Facilities that are interconnected with the District's Distribution System for more than 60 cycles (one second).

Periodic Test: A test performed on part or all of a Generating Facility/Interconnection Facilities at pre-determined time or operational intervals to achieve one or more of the following: (1) Verify specific aspects of its performance; (2) Calibrate instrumentation; and (3) Verify and reestablish instrument or protective function set-points.

Point of Common Coupling (PCC): The transfer point for electricity between the electrical conductors of the District and the electrical conductors of the Producer.

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 and/or Section 218 Load.

Point of Interconnection: The electrical transfer point between a Generating Facility and the Distribution System. This may or may not be coincident with the point of common coupling.

Producer: The applicant, customer, or person/entity that executes an Interconnection Agreement with the District. 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 and this Rule.

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 and/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 modified 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.

Scheduled Operation Date: The date specified in the Interconnection Agreement when the Generating Facility is, by the Producer's estimate, expected to begin operation pursuant to this Rule.

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

Single Line Diagram; Single Line Drawing: A schematic drawing, showing the major electric switchgear, protective function 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.

Smart Inverter: A Generating Facility's inverter that performs functions that, when activated, can autonomously contribute to grid support during excursions from normal operating voltage and frequency system conditions by providing: dynamic reactive/real power support, voltage and frequency ride-through, ramp rate controls, communication systems with ability to accept external commands and other functions.

Spot Networks: A Spot Network is a type of distribution system found within modern commercial buildings to provide high reliability or service to a single customer.

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 volts on a particular base voltage, (e.g. 6 volts on a 120-volt base, yielding a 5% drop).

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 rules of the District.

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

Transfer Trip: A protective function that trips a Generating Facility remotely by means of an automated communications link controlled by the District.

Trip: The act of a Generating Facility to cease to energize or disconnect from the District's Distribution System automatically due to a District Distribution System disturbance. Following a trip, the Smart Inverter must delay re-energization or reconnection for a preset period of time once the voltage and frequency of the District's Distribution System are within normal ranges.

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 District's Distribution System, without the approval of the District.

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.

Utility Service Meter: The meter located in a customer's main electrical panel. This meter is capable of separately recording power flow into, and power flow out of, a customer's facility or premise.

Visible Disconnect: An electrical switching device that can separate the Generating Facility from the District's 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.

VRefOfs: The offset from the reference voltage due to the location of the Smart Inverter system on a distribution feeder. This may be a setting or may be calculated dynamically from local voltage measurements.

D. General Rules, Rights, and Obligations

1. A Producer must comply with this Rule, execute an Interconnection Agreement with the District, and receive the District's express written permission before parallel operation of its Generating Facility with the District's Distribution System.
2. A Producer requiring other electric services from the District including, but not limited to, Distribution Service provided by the District during periods of curtailment or interruption of the Producer's Generating Facility, will enter into agreements with the District for such services in accordance with the District's Rates and Rules.
3. A Producer shall ascertain and comply with applicable District Rates and Rules; applicable rules of the Public Utilities Commission (PUC); applicable rules, tariffs and regulations of the Federal Energy Regulatory Commission (FERC); 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 Producer's Generating Facility and Interconnection Facilities.
4. The District shall have the right to review the design of a Producer's Generating and Interconnection Facilities and to inspect a Producer's Generating and/or Interconnection Facilities prior to the commencement of parallel operation with the District's Distribution System. The Producer is responsible for all local building permits and final inspections with local governing agencies before the District performs its final inspection. The District may require a Producer to make modifications as necessary to comply with the requirements of this Rule. The District may require proof that the Producer's protection system is performing to the level required in this Rule and the Interconnection Agreement. The District's review and authorization for parallel operation shall not be construed as confirming or endorsing the Producer's design or as warranting the Generating and/or Interconnection Facilities' safety, durability or reliability. The District shall not, by reason of such review or lack of review, be responsible for the strength, adequacy or capacity of such equipment.
5. A Producer's Generating Facility and Interconnection Facilities shall be reasonably accessible to District personnel as necessary for the District to perform its duties and exercise its rights, in accordance with any Interconnection Agreement between the District and the Producer.
6. The District shall treat Interconnection information provided to the District by an applicant, Producer, and/or customer in a confidential manner, unless disclosure is otherwise required by applicable law, or as deemed necessary by the District. Notwithstanding the foregoing, the District may be entitled to disclose Generator information to a person, entity, and/or other regulatory bodies with authority or concern over the construction, operation, or development of the Generating Facility.
7. A Producer shall operate and maintain its Generating Facility and Interconnection Facilities in accordance with Prudent Electrical Practices and shall maintain compliance with this Rule.
8. The District may limit the operation, disconnect, or require the disconnection of a Producer's Generating Facility from the District's Distribution System at any time, with or without notice, in the event of an emergency, or to correct unsafe operating conditions. The District may also limit the operation, disconnect, or require the disconnection of a Producer's Generating Facility from the District's Distribution System upon the provision of reasonable written notice: (1) to allow for routine maintenance, repairs or modifications to the District's Distribution System; (2) upon the District's determination that a Producer's Generating Facility is not in compliance with this Rule; or (3) upon termination of the Interconnection Agreement. Upon the Producer's written request, the District shall provide a written explanation of the reason for such curtailment or disconnection. The District shall not be obligated to compensate Producer for any loss of use of generation of electricity during any and all periods of such disconnection.
9. A Producer may transfer its Interconnection rights to another person or entity in the Interconnection Agreement or Application as long as the new Interconnection Agreement or Application is submitted and approved by the District. The point of interconnection shall not change.

E. Application and Interconnection Process

1. Application Process

- a. Applicant Initiates Contact with the District. Upon request, the District will provide information and documents to a potential applicant. Unless otherwise agreed upon, all such information shall normally be sent to the applicant within five (5) business days following the initial request from the applicant.
- b. Applicant Completes an Application which is on file at the District (Small Generator Interconnection Request or a PV Program Reservation Request Form). Applicant shall complete and file the application and supply any relevant additional information requested by the District. A non-refundable Interconnection Fee (as specified in Appendix A) shall be included with the application.
 - 1) Normally, within ten (10) business days of receiving the application, the District shall acknowledge its receipt and state whether the application has been completed adequately. If defects are noted, the applicant shall, in a timely manner, correct the deficiencies needed to establish a satisfactory application. The District reserves the right to reject any application that it considers deficient.
 - 2) Applications that are over one year old (from the date of the District's acknowledgement) without a signed Interconnection Agreement, or a Generating Facility that has not been approved for parallel operation within one year of completion of all applicable review and/or studies are subject to cancellation by the District; however, the District will not cancel an application if the Producer provides reasonable evidence that the project is still active.
- c. The District Performs the Interconnection Review and Develops Preliminary Cost Estimates and Interconnection Requirements.
 - 1) Upon receipt of a satisfactorily completed application, fees, and any additional information necessary to evaluate the interconnection of a Generating Facility, the District shall perform the Interconnection Review. This Review will determine if: (a) the Generating Facility can be connected to the District's Distribution System with no modifications; (b) the Generating Facility requires system modifications to the District's Distribution System to accommodate the applicant's Generating Facility; or (c) the Generating Facility cannot be connected to the District's Distribution System.
 - 2) The District shall complete the Interconnection Review, absent any extraordinary circumstances, within 45 business days after its determination that the application is complete. If the Review determines the proposed Generating Facility can be interconnected with no modifications to the District's Distribution System, the District will provide the applicant with an Interconnection Agreement for the applicant's signature. If the Review determines the proposed Generating Facility will require improvements to the District's Distribution System, the District will provide a cost estimate for these improvements in order to accommodate the applicant's Generating Facility.
 - 3) The Interconnection Review will result in the District providing the interconnection requirements for the interconnection, an Interconnection Agreement for the applicant's signature, and a cost estimate for the system modifications to the District's Distribution System to accommodate the applicant's Generating Facility, if system modifications to the District's Distribution System are required.

2. Interconnection Process

- a. Applicant and the District enter into an Interconnection Agreement and, where required, an agreement for Distribution System modifications. The District shall provide the applicant with an executable version for signature of the Electrical Interconnection Agreement on file at the District (Small Generator Interconnection Agreement or Electrical Interconnection Agreement for Net Energy Metering). Where the Interconnection Review performed by the District has determined that modifications to its Distribution System are required, the applicant shall submit to the District the estimated costs for the required work prior to entering into the Interconnection Agreement.
- b. After executing the applicable agreements, the District will commence engineering, construction, and installation of the District's Distribution System modifications or Interconnection Facilities which have been identified in the agreements. The parties will use good faith efforts to meet schedules and estimated costs as appropriate. Where applicable, the District installs required Interconnection Facilities and/or modifies the District's Distribution System.
- c. Producer arranges and completes commissioning testing of Generating Facility and Producer's Interconnection Facilities. The Producer is responsible for testing new Generating Facilities and associated Interconnection Facilities according to Section M.3 to ensure compliance with the safety and reliability provisions of this Rule prior to being operated in parallel with the District's Distribution System.
- d. The District Authorizes Parallel Operation or Momentary Parallel Operation. The District shall authorize the Producer's Generating Facility for parallel operation or momentary parallel operation with the District's Distribution System, in writing, within five (5) calendar days of satisfactory compliance with the terms of all applicable agreements. Compliance may include, but not be limited to, provision of any required documentation and satisfactorily completing any required inspections or tests as described herein or in the agreements formed between the Producer and the District. A Producer shall not commence parallel operation of its Generating Facility with the District's System unless it has received the District's express written permission to do so.
- e. Interconnection Agreement. Any operation of a generator interconnected to the District's electrical system, other than for brief on-site testing by the electrical contractor, where the District has not provided formal authorization for operation will

be deemed an electrical safety violation and will be subject to immediate disconnection from the District's system (as per Rule No. 11) at the service point of the electrical service to which the generation is interconnected. All applicable fees listed in Appendix A shall apply, including the Disconnect Fee.

F. Generating Facility Design and Operating Requirements

1. General Interconnection and Protective Function Requirements

- a. Protective Functions Required. Generating Facilities operating in parallel with the District's Distribution System shall be equipped with the following protective functions to sense abnormal conditions on the District's Distribution System and cause the Generating Facility to be automatically disconnected from the District's Distribution System or to prevent the Generating Facility from being connected to the District's Distribution System inappropriately:
 - 1) Over and under voltage trip functions and over and under frequency trip functions;
 - 2) 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 the District's Distribution System unless the District'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
 - 3) A function to prevent the Generating Facility from contributing to the formation of an Unintended Island, and cease to energize the District's System within two (2) seconds of the formation of an Unintended Island. The Generating Facility shall cease to energize the District's Distribution System for faults on the District's Distribution System circuit to which it is connected (IEEE 1547-4.2.1). The Generating Facility shall cease to energize the District's Distribution System circuit prior to reclosure by the District's Distribution System equipment (IEEE 1547-4.2.2).
- b. Momentary Paralleling Generating Facilities. With the District's approval, the transfer switch or scheme used to transfer the Producer's loads from the District's Distribution System to Producer's Generating Facility may be used in lieu of the protective functions required for parallel operation. Momentary Paralleling to the District's System shall be one second (60 cycles) or less.
- c. Purpose of Protective Functions. The protective functions and requirements of this Rule are designed to protect the District's Distribution System and not the Generating Facility. A Producer shall be solely responsible for providing adequate protection for its Generating Facility and Interconnection Facilities. The Producer's protective functions shall not impact the operation of other protective functions utilized on the District's Distribution System in a manner that would affect the District's capability of providing reliable service to its customers.
- d. Suitable Equipment Required. Circuit breakers or other interrupting devices located at the point of common coupling (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 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 the District's Distribution System. The Generating Facility 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 and shall comply with IEEE 1547-5.1.3.2.
- e. Visible Disconnect Required. When required by the District's operating practices, the Producer shall furnish and install a ganged, manually-operated isolating switch (or a comparable device mutually agreed upon by the District and the Producer) near the point of interconnection to isolate the Generating Facility from the District's Distribution System. The device does not have to be rated for load break nor provide overcurrent protection.

The device must:

- 1) Allow visible verification that separation has been accomplished. (This requirement may be met by opening the enclosure to observe contact separation.)
 - 2) Include markings or signage that clearly indicate open and closed positions.
 - 3) Be capable of being reached quickly and conveniently 24 hours a day by District personnel for construction, maintenance, inspection, testing, reading, or to isolate the Generating Facility from the District's Distribution System, without obstacles or requiring those seeking access to obtain keys, special permission, or security clearances.
 - 4) Be capable of being locked in the open position.
 - 5) Be clearly marked on the submitted single line diagram and its type and location approved by the District prior to installation. If the device is not adjacent to the PCC, permanent signage must be installed at a District-approved location providing a clear description of the location of the device.
- f. Drawings Required. Prior to parallel operation or momentary parallel operation of the Generating Facility, the District shall approve the Producer's protective function, control diagrams, and location of Producer's disconnect switch and utility meter. Generating Facilities equipped with a protective function and control scheme previously approved by the District for system-wide application may satisfy this requirement by reference to previously approved drawings and diagrams.

- g. Generating Facility Conditions Not Identified. In the event this Rule does not address the interconnection conditions for a particular Generating Facility, the District and Producer may agree upon other arrangements.
- h. Generating Facility Modification. Customer may not make modifications to the Generating Facility, including but not limited to addition of storage devices, upgraded panels or other equipment that increase the installed capacity of the Generating Facility system, or that otherwise materially modify the Generating Facility, without the prior written authorization of the District. To secure prior written authorization, customer must sign a new Net Metering Agreement with the District and secure advance written approval of Generating Facility modifications from the District prior to interconnection of any modified Generating Facility to the District's system. The modified Generating Facility will be subject to the Net Metering Schedule in effect at the time the application for modification of Generating Facility is approved subject to the following: A customer may modify a Generating Facility and remain on its existing Rate Schedule provided that the modified Generating Facility does not exceed 110% capacity of the original interconnected Generating Facility.

2. Prevention of Interference

The Producer shall not operate Generating or Interconnection Facilities that superimpose a voltage or current upon the District's Distribution System that interferes with District operations, service to the District's 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 the District. If the Producer does not take corrective action in a timely manner, or continues to operate the Facilities causing interference without restriction or limit, the District may, without liability, disconnect the Producer's Facilities from the District's Distribution System, in accordance with Section D.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 the District'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 1 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 the District'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.
 - 1) Generating Facilities (30 kVA or less). Generating Facilities with a Gross Nameplate Rating of 30 kVA or less shall be capable of operating within the voltage range normally experienced on the District's Distribution System. The operating range 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). 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 $\pm 5\%$ of nominal.
 - 2) Generating Facilities (greater than 30 kVA). The District may have specific operating voltage ranges for Generating Facilities with Gross Nameplate Ratings greater than 30 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. Voltage shall be detected at either the PCC or the point of interconnection, with settings compensated to account for the voltage at the PCC. However, the voltage range at the PCC, with the generator on-line shall stay within $\pm 5\%$ of nominal.
 - 3) Voltage Disturbances. Whenever the District's Distribution System voltage at the PCC varies from and remains outside normal (nominally 120 volts) by the predetermined amounts set forth in Table 1, the Generating Facility's protective functions shall cause the Generator(s) to become isolated from the District's Distribution System:

Table 1: Voltage Trip Settings for Generating Facilities

Voltage at PCC ⁽¹⁾		Maximum Trip Time ⁽²⁾	
Assuming 120 Volt Base	% of Nominal Voltage	# of Cycles (Assuming 60 Hz Nominal)	Seconds
Less than 60 Volts	Less than 50%	10 Cycles	0.16 Second
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 Second

⁽¹⁾ The ranges above are used to trip the generator during abnormal system conditions.

⁽²⁾ Maximum Trip Time refers to the time between the onset of the abnormal condition and the Generating Facility ceasing to energize the District's Distribution System. Protective function sensing equipment and circuits may remain connected to the District'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). For Generating Facilities with a Gross Nameplate Rating greater than 30 kVA, set points shall be field adjustable and different voltage set points and trip times from those in Table 1 may be negotiated with the District.

- c. Paralleling. The Generating Facility shall parallel with the District's Distribution System without causing a voltage fluctuation at the PCC greater than $\pm 5\%$ of the prevailing voltage level of the District's Distribution System at the PCC, and meet the flicker requirements of F.2.d. Section M provides technology specific tests for evaluating the paralleling Function (IEEE 1547-4.1.3).
- d. Flicker. The Generating Facility shall not create objectionable flicker for other customers on the District'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 Figure 10.3 "Maximum Permissible Voltage Fluctuations" identified in IEEE 519-1992 (IEEE Recommended Practices and Requirements for Harmonic Control in Electric Power Systems). This requirement is necessary to minimize the adverse voltage effects experienced by other customers on the District'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.
- e. Integration with the District's Distribution System Grounding. The grounding scheme of the Generating Facility interconnection shall not cause overvoltages that exceed the rating of the equipment connected to the District and shall not disrupt the coordination of the ground fault protection on the District's Distribution System (IEEE 1547-4.1.2).
- f. Frequency. The District's controls system frequency and the Generating Facility shall operate in synchronism with the District's Distribution System. Whenever the District's Distribution System frequency at the PCC varies from and remains outside normal (nominally 60 Hz) by the predetermined amounts set forth in Table 2, the Generating Facility's protective functions shall cease to energize the District's Distribution System within the stated maximum trip time.

Table 2: Frequency Trip Settings

Generating Facility Rating	Frequency Range (Assuming 60 Hz Nominal)	Maximum Trip Time ⁽¹⁾ (Assuming 60 Cycles per Second)
Less than or equal to 30 kW	Less than 59.3 Hz	10 cycles
	Greater than 60.5 Hz	10 Cycles
Greater than 30 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 the District's Distribution System. Protective function sensing equipment and circuits may remain connected to the District'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). For Generating Facilities with a Gross Nameplate Rating greater than 30 kVA, set points shall be field adjustable and different voltage set points and trip times from those in Table 2 may be negotiated with the District.

⁽²⁾ Unless otherwise required by the District, 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 the District's Distribution System at the PCC shall not exceed the limits stated below in Table 3. The harmonic current injections shall be exclusive of any harmonic currents due to harmonic voltage distortion present in the District'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 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 the District'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 the District. The Producer shall notify the District if it is using the Generating Facility for power factor correction. Unless otherwise agreed upon by the Producer and the District, Generating Facilities shall automatically regulate power factor, not voltage, while operating in parallel with the District'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 the District's Distribution System by means of either manual or automatic synchronizing Function. 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 F.2.d (Flicker) (IEEE 1547-4.2.5). Unless otherwise agreed upon by the Producer and the District, synchronous generators shall automatically regulate power factor, not voltage, while operating in parallel with the District's Distribution System. A power system stabilization Function is specifically not required for Generating Facilities under 10 MW Net Nameplate Rating.
 - 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 the District's 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 Producer's side of the PCC,

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

- c. Inverters. 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 District's Distribution or Transmission System.
 - 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 neutral 240-volt service must be installed such that no more than 6 kVA of imbalanced power is applied to the two "legs" 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.
4. Limitations on Inverters Not Classified as Smart Inverters
- a. Inverter based systems may continue to be installed per Section F until the later of either (1) December 31, 2015, or (2) twelve (12) months after the date the Supplement SA of UL-1741 (with California requirements) is approved. Section G may be used, in all or in part, for inverter based technologies by mutual agreement of the District and the applicant.
 - b. The replacement of an existing inverter to an inverter that is of equal or greater ability than the original is allowed per Section F. Section G may be used, in all or in part, for replacement inverter based technologies by mutual agreement of the District and the applicant.
5. Supplemental Generating Facility Requirements
- a. Fault Detection. A Generating Facility with an SCCR exceeding 0.1 or one that does not cease to energize the District's Distribution System within two (2) 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 the District's Distribution System within two (2) 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 ceases to energize the District's Distribution System within two (2) seconds, the District may require a transfer trip system or an equivalent protective function.
 - c. Reclose Blocking. Where the aggregate Generating Facility capacity exceeds 50% of the minimum load on any automatic reclosing device, the District may require additional protective functions, including, but not limited to reclose-blocking on some of the automatic reclosing devices.
 - d. Unintended Islanding. 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, (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.

G. Smart Inverter Generating Facility Design and Operating Requirements

Section F shall continue to be used for interconnection of inverter based technologies until the later of either (1) December 31, 2015, or (2) twelve (12) months after the date of the Supplement SA of UL-1741 (with California requirements) is approved by the full UL-1741 Standards Technical Panel (STP). Following such date, this Section G shall apply for interconnection of inverter based technologies. Until such date, this Section G may be used, in all or in part, for inverter based technologies by mutual agreement of the District and the applicant.

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). In the event of conflict between this Rule and IEEE 1547-2003, this Rule shall take precedence. This Rule does not adopt the Generating Facility power limitation of 10 MW incorporated in IEEE 1547.

1. General Interconnection and Protective Function Requirements
- a. Protective Functions Required. Smart Inverters operating in parallel with the District's Distribution System shall be equipped with the following protective functions to sense abnormal conditions on the District's Distribution System and cause the Smart Inverter to be automatically disconnected from the District's Distribution System or to prevent the Smart Inverter from being connected to the District's Distribution System inappropriately:
 - 1) Over and under voltage trip functions and over and under frequency trip functions;
 - 2) 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 the District's Distribution System unless the District'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
 - 3) A function to prevent the Smart Inverter from contributing to the formation of an Unintended Island, and cease to energize the District's System within two (2) seconds of the formation of an Unintended Island. The Smart Inverter shall cease to energize the District's Distribution System for faults on the District's Distribution System circuit to which

it is connected (IEEE 1547-4.2.1). The Smart Inverter shall cease to energize the District's Distribution System circuit prior to reclosure by the District's Distribution System equipment (IEEE 1547-4.2.2).

- b. Momentary Paralleling Generating Facilities. With the District's approval, the transfer switch or scheme used to transfer the Producer's loads from the District's Distribution System to Producer's Generating Facility may be used in lieu of the protective functions required for parallel operation. Momentary Paralleling to the District's System shall be one second (60 cycles) or less.
- c. Purpose of Protective Functions. The protective functions and requirements of this Rule are designed to protect the District's Distribution System and not the Generating Facility. A Producer shall be solely responsible for providing adequate protection for its Generating Facility and Interconnection Facilities. The Producer's protective functions shall not impact the operation of other protective functions utilized on the District's Distribution System in a manner that would affect the District's capability of providing reliable service to its customers.
- d. Suitable Equipment Required. Circuit breakers or other interrupting devices 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 one device shall not potentially compromise the safety and reliability of the District'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.
- e. Visible Disconnect Required. When required by the District's operating practices, the Producer shall furnish and install a ganged, manually-operated isolating switch (or a comparable device mutually agreed upon by the District and the Producer) near the point of interconnection to isolate the Smart Inverter from the District's Distribution System. The device does not have to be rated for load break nor provide overcurrent protection.

The device must:

- 1) Allow visible verification that separation has been accomplished. (This requirement may be met by opening the enclosure to observe contact separation.)
 - 2) Include markings or signage that clearly indicate open and closed positions.
 - 3) Be capable of being reached quickly and conveniently 24 hours a day by District personnel for construction, maintenance, inspection, testing, reading, or to isolate the Smart Inverter from the District's Distribution System, without obstacles or requiring those seeking access to obtain keys, special permission, or security clearances.
 - 4) Be capable of being locked in the open position.
 - 5) Be clearly marked on the submitted single line diagram and its type and location approved by the District prior to installation. If the device is not adjacent to the PCC, permanent signage must be installed at a District-approved location providing a clear description of the location of the device.
- f. Drawings Required. Prior to parallel operation or momentary parallel operation of the Smart Inverter, the District shall approve the Producer's protective function, control diagrams, and location of Producer's disconnect switch and utility meter. Generating Facilities equipped with a protective function and control scheme previously approved by the District for system-wide application may satisfy this requirement by reference to previously approved drawings and diagrams.
 - g. Generating Facility Conditions Not Identified. In the event this Rule does not address the interconnection conditions for a particular Smart Inverter, the District and Producer may agree upon other arrangements.

2. Prevention of Interference

The Producer shall not operate Smart Inverters that superimpose a voltage or current upon the District's Distribution System that interferes with District operations, service to the District's 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 the District. If the Producer does not take corrective action in a timely manner, or continues to operate the Facilities causing interference without restriction or limit, the District may, without liability, disconnect the Producer's Facilities from the District's Distribution System, in accordance with Section D.8 of this Rule. To eliminate undesirable interference caused by its operation, each Smart Inverter shall meet the following criteria:

- a. Voltage Regulation. If approved by the District, the Smart Inverter may actively regulate the voltage at the PCC while in parallel with the District'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).
- b. Voltage Trip and Ride-Through Settings. The voltage ranges in Table 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 the District'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 Smart Inverter is connected.

- 1) Smart Inverters. Smart Inverters shall be capable of operating within the voltage range normally experienced on the District'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 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 $\pm 5\%$ of nominal.
- 2) Voltage Disturbances. Whenever the District's Distribution System voltage at the PCC varies from and remains outside normal (nominally 120 volts) by the predetermined amounts set forth in Table 4, the Smart Inverter's protective functions shall cause the Smart Inverter(s) to become isolated from the District's Distribution System:
 - a) The Smart Inverter shall stay connected to the District's Distribution System while the grid remains within the "Ride-Through Until" voltage-time range and must stay connected in the corresponding Operating Mode.
 - b) 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 second.
 - c) 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 the District.
 - d) 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 two (2) seconds.
 - e) If District'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 two (2) seconds.
 - f) Different voltage-time settings could be permitted by the District.

Table 4: Voltage Ride-Through

Region	Voltage at PCC (% Nominal Voltage)	Ride-Through Until	Operating Mode	Maximum Trip Time
High Voltage 2 (HV2)	$V \geq 120\%$			0.16 Second
High Voltage 1 (HV1)	$110\% < V < 120\%$	12 Seconds	Momentary Cessation	13 Seconds
Near Nominal (NN)	$88\% \leq V \leq 110\%$	Indefinite	Continuous Operations	Not Applicable
Low Voltage 1 (LV1)	$70\% \leq V < 88\%$	20 Seconds	Mandatory Operations	21 Seconds
Low Voltage 2 (LV2)	$50\% \leq V < 70\%$	10 Seconds	Mandatory Operations	11 Seconds
Low Voltage 3 (LV3)	$V < 50\%$	1 Second	Momentary Cessation	1.5 Seconds

- c. Paralleling. The Generating Facility shall parallel with the District's Distribution System without causing a voltage fluctuation at the PCC greater than $\pm 5\%$ of the prevailing voltage level of the District's Distribution System at the PCC, and meet the flicker requirements of G.2.d. Section M provides technology specific tests for evaluating the paralleling Function (IEEE 1547-4.1.3).
- d. Flicker. The Generating Facility shall not create objectionable flicker for other customers on the District'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 Figure 10.3 "Maximum Permissible Voltage Fluctuations" identified in IEEE 519-1992 (IEEE Recommended Practices and Requirements for Harmonic Control in Electric Power Systems). This requirement is necessary to minimize the adverse voltage effects experienced by other customers on the District'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 the District's Distribution System Grounding. The grounding scheme of the Generating Facility interconnection shall not cause overvoltages that exceed the rating of the equipment connected to the District and shall not disrupt the coordination of the ground fault protection on the District's Distribution System (IEEE 1547-4.1.2).
- f. Frequency. The District's controls system frequency and the Generating Facility shall operate in synchronism with the District's Distribution System. Whenever the District's Distribution System frequency at the PCC varies from and remains outside normal (nominally 60 Hz) by the predetermined amounts set forth in Table 5, the Generating Facility's protective functions shall cease to energize the District's Distribution System within the stated maximum trip time.
 - 1) Frequency Ride-Through Requirements. Smart Inverter based systems shall remain connected to the District's Distribution System while the grid is within the frequency-time range indicated in Table 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 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 the District.

Table 5: Frequency Ride-Through and Trip Settings

System Frequency Default Settings (Hz)	Minimum Range of Adjustment (Hz)	Ride-Through Until	Ride-Through Operational Mode	Maximum Trip Time
$f > 62$	62 - 64	No Ride Through	Not Applicable	0.16 Second
$60.5 < f \leq 62$	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 Second

- g. Harmonics. When the Generating Facility is serving balanced linear loads, harmonic current injection into the District's Distribution System at the PCC shall not exceed the limits stated below in Table 6. The harmonic current injections shall be exclusive of any harmonic currents due to harmonic voltage distortion present in the District's Distribution System without the Smart Inverter connected (IEEE 1547-4.3.3). The harmonic distortion of a Smart Inverter located at a customer's site shall be evaluated using the same criteria as for the Host Loads.

Table 6: Maximum Harmonic Current Distortion in Percent of Current (I)⁽¹⁾⁽²⁾

Individual Harmonic Order h, (odd harmonics) ⁽³⁾	$h < 11$	$11 \leq h < 17$	$17 \leq h < 23$	$23 \leq h < 35$	$35 \leq h$	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. Smart Inverters should not inject direct current greater than 0.5% of rated output current into the District's Distribution System.
- i. 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 District-specified power factor in accordance with the following requirements:
- 1) Default Power Factor setting: 1.0 ± 0.01 (0.99 Lagging to 0.99 Leading).
 - 2) 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.
 - 3) 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.
- j. 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 (≤ 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 the District requirements. The District 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 the District. The Smart Inverter shall be capable of providing dynamic reactive power compensation (dynamic Volt/VAR operation) within the following constraints:
- 1) The Smart Inverter shall not cause the line voltage at the PCC to go outside the requirements of the latest version of ANSI C84.1, Range A.
 - 2) 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.
 - 3) 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 the District.
- k. Ramp Rate Requirements. The Smart Inverter is required to have the following ramp controls for at least the following 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.

- 1) 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 upon by the District and the Producer.
 - 2) 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 the District and the Producer.
- I. Default Activation States for Phase 1 Functions. Unless otherwise provided by the District, the default settings will be as follows:
- 1) Anti-islanding – activated
 - 2) Low/High Voltage Ride-Through – activated
 - 3) Low/High Frequency Ride-Through – activated
 - 4) Dynamic Volt/VAR operations – deactivated
 - 5) Ramp rates – activated
 - 6) Fixed power factor – activated
 - 7) Reconnect by “soft-start” methods – activated
 - 8) These default activation states may be modified by mutual agreement between the District and Producer.
- m. Automatic Transfer (Load Shedding or Transfer). The voltage and frequency ride-through requirements of Section G.2.b.2) and G.2.f shall not apply if either:
- 1) The real power across the PCC is continuously maintained at a value less than 10% of the aggregate rating of the Smart Inverters connected to the Generating Facility prior to any voltage disturbance, and the Generating Facility disconnects from the District’s Distribution system, along with Generating Facility load, such that the net change in real power flow from or to the District is less than 10% of the aggregate Smart Inverter capacity; or
 - 2) Generating 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 second of Smart Inverter disconnection.
3. Technology Specific Requirements
- Grid-interactive inverters do not require separate synchronizing equipment. Non grid-interactive or “stand-alone” inverters shall not be used for Parallel Operation with District’s Distribution System.
4. Supplemental Smart Inverter Requirements
- a. Fault Detection. A Smart Inverter with an SCCR exceeding 0.1 or one that does not cease to energize the District’s Distribution System within two (2) 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 the District’s Distribution System within two (2) 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 ceases to energize the District’s Distribution System within two (2) seconds, the District may require a transfer trip system or an equivalent protective function.
 - c. Reclose Blocking. Where the aggregate Generating Facility capacity exceeds 15% of the peak load on any automatic reclosing device, the District may require additional protective functions, including, but not limited to reclose-blocking on some of the automatic reclosing devices.

H. Maintenance and Permits

The Producer shall: (1) maintain the Facility and Interconnection Facilities in a safe and prudent manner and in conformance with all applicable laws and regulations including, but not limited to, requirements of Sections F and G above and (2) to the extent that future requirements may dictate, obtain any government authorizations or permits required for the operation of the Generator or Generating Facility. The Producer shall reimburse the District for any and all losses, damages, claims, penalties or liability the District incurs as a result of the Producer’s failure to obtain or maintain any government authorizations and permits required for construction and operation of the Generating Facility.

I. Access to Premises

The District may enter the customer’s premises without prior notice (1) to inspect at all reasonable hours the Generating Facility’s protective devices and read or test any meter for the Generator or Generating Facility; (2) to disconnect, at any time, without notice, the Generator or Generating Facility if, in District’s sole opinion, a hazardous condition exists and that immediate action is necessary to protect persons, or District’s facilities or property of others from damage or interference caused by (a) the Generator or Generating Facility or (b) the customer and/or Producer’s failure to comply with requirements of these provisions; and (3) if applicable, monthly to

read the digital meter for billing purposes. Self-reads and reads from adjacent properties are not permitted. Failure to comply with this policy may result in disconnection of service and/or termination of Interconnection Agreement with the District.

J. Conditions of Facility Operations

1. The producer shall deliver electricity from the Generating Facility to the District at District's meter.
2. The Producer, and not the District, shall be solely responsible for all legal and financial obligations arising from the construction, installation, design, operation and maintenance of the Generator or Generating Facility in accordance with all applicable laws and regulations.
3. The Producer, at the Producer's sole expense, shall obtain and possess all permits and authorizations in accordance with all applicable laws and regulations for the construction, installation, design, operation and maintenance of the Generator or Generating Facility.
4. The Producer shall not connect the Generator or Generating Facility, or any portion of it, to the District's Distribution System, until the Generator or Generating Facility has passed District inspection. Such approval shall not be unreasonably withheld. The District shall have the right to have representatives present at the initial testing of the Generator or Generating Facility.
5. The Producer may reconnect its Generator or Generating Facility to the District's Distribution System following normal operational outages and interruptions without notifying the District unless the District has disconnected services, or the District notifies the Producer that a reasonable possibility exists that reconnection would pose a safety hazard.
6. If the District has disconnected service to the Generator or Generating Facility, or the District has notified the Producer that a reasonable possibility exists that reconnection would pose a safety hazard, the Producer may call the District at 1-209-526-7373 to request authorization to reconnect the Generator or Generating Facility.

K. Interconnection Facilities and Distribution System Modifications Ownership and Financing

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 the District'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 Review described in Section E.
 - b. Ownership. Interconnection Facilities installed on Producer's side of the PCC may be owned, operated and maintained by the Producer or the District. Interconnection Facilities installed on the District's side of the PCC and Distribution System modifications shall be owned, operated and maintained only by the District.
2. Responsibility of Costs of Interconnecting a Generating Facility
 - a. Review and Additional Commissioning Test Verifications (pre-parallel inspections) Costs. A Producer shall be responsible for the reasonably incurred costs of the reviews and additional commissioning test verifications (pre-parallel inspections) conducted pursuant to Section E of this Rule. If the initial commissioning test verification (pre-parallel inspection) is not successful through no fault of the District, the District may impose upon the Producer a cost-based charge for subsequent commissioning test verifications (pre-parallel inspections). All costs for additional commissioning test verifications (pre-parallel inspections) shall be paid by Producer in advance. The cost estimate provided by the District shall consist of the hourly rate multiplied by the hours estimated to be incurred by the District. If the initial commissioning test verification (pre-parallel inspection) is not successful through the fault of the District, that visit will not be considered the initial commissioning test verification (pre-parallel inspection).
 - b. Facility Costs. A 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 the District in providing, operating, or maintaining the Interconnection Facilities and Distribution System modifications required solely for the interconnection of the Producer's Generating Facility with the District's Distribution System.
 - c. Separation of Costs. Should the District combine the installation of Interconnection Facilities or Distribution System modifications required for the interconnection of a Generating Facility with modifications to the District's Distribution System to serve other customers or producers, the District shall not include the costs of such separate or incremental facilities in the amounts billed to the Producer.
 - d. Reconciliation of Costs and Payments. Within a reasonable time after the interconnection of a Producer's Generating Facility, the District will reconcile its actual costs related to the Generating Facility against any advance payments made by the Producer. The Producer will receive either a bill for any balance due or a reimbursement for overpayment as determined by the District's reconciliation.

L. Metering, Monitoring and Telemetry

1. General Requirements

All Generating Facilities shall be metered in accordance with this Section L and shall meet all applicable standards of the District contained in the District's applicable Rules and published the District documents dealing with metering specifications.

2. Metering

The ownership, installation, operation, reading and testing of revenue metering equipment for Generating Facilities shall be by the District.

3. Net Generation Output Metering (NGOM)

Generating Facility customers may be required to install NGOM for evaluation, monitoring and verification purposes and to determine applicable standby and non-bypassable charges as defined in the District's Rules, and for Distribution System planning and operations.

4. Point of Common Coupling Metering

For purposes of assessing the District charges for retail service, the Producer's PCC metering shall be reviewed by the District, and if required, replaced to ensure that it will appropriately measure electric power. Where required, the customer's existing meter may be replaced with a bi-directional meter so that power deliveries to and from the Producer's site can be separately recorded. Alternately, the Producer may, at its sole option and cost, require the District to install multi-metering equipment to separately record power deliveries to the District's Distribution System and retail purchases from the District. Where necessary, such PCC metering shall be designed to prevent reverse registration.

5. Telemetry

If the nameplate rating of the Generating Facility is 1 MW or greater, telemetry equipment may be required at the District's discretion and at the Producer's expense. Telemetry may also be required for those Generating Facilities that are not Net Energy Metering Facilities.

6. Location

Where the District-owned metering is located on the Producer's premises, Producer shall provide, at no expense to the District, a suitable location as approved by the District for all such metering equipment.

7. Costs of Metering

The Producer will bear all costs of the metering required by this Rule, including the incremental costs of operating and maintaining the metering equipment.

M. Certification and Testing Criteria

1. Introduction

This Section describes the test procedures and requirements for equipment used for the interconnection of Generating Facilities to the District's Distribution System. Included are commissioning testing and periodic testing. The procedures listed rely heavily on those described in appropriate Underwriters Laboratory (UL), Institute of Electrical and Electronic Engineers (IEEE), and International Electrotechnical Commission (IEC) documents—most notably UL 1741, IEEE 929, and IEEE 1547.

The technical requirements in Sections F and G of this Rule are intended to provide assurance that the Generating Facility's equipment will not adversely affect the District's Distribution System and that a Generating Facility will cease providing power to the District's Distribution System under abnormal conditions. The tests were developed assuming a low level of Generating Facility penetration or number of connections to the District's Distribution System. At high levels of Generating Facility penetration, additional requirements and corresponding test procedures may need to be defined.

2. Certified Interconnection Equipment

Equipment tested and approved by an accredited Nationally Recognized Testing Laboratory (NRTL) as having met both the type testing and production testing requirements described in California Rule 21 is considered to be certified equipment for purposes of interconnection with the District's Distribution System. Certification may apply to either a pre-packaged system or an assembly of components that address the necessary functions. Equipment certified by a NRTL shall have a Certificate containing, at a minimum, the following information for each device:

a. Administrative:

- 1) The effective date of certification or applicable serial number (range or first in series), and/or other proof that certification is current;
- 2) Equipment model number(s) of the certified equipment;
- 3) The software version utilized in the equipment, if applicable;
- 4) Test procedures specified (including date or revision number); and

- 5) Laboratory accreditation (by whom and to what standard).
- b. Technical (as appropriate):
 - 1) Device ratings (kW, kVA, Volts, Amps, etc.);
 - 2) Maximum available fault current in Amps;
 - 3) In-rush Current in Amps;
 - 4) Trip points, if factory set (trip value and timing);
 - 5) Trip point and timing ranges for adjustable settings;
 - 6) Nominal power factor or range if adjustable;
 - 7) If the equipment is certified for Non-Exporting and the method used (reverse power or under power); and
 - 8) If the equipment is certified Non-Islanding.
 - 9) It is the responsibility of the equipment manufacturer to ensure that certification information is made publicly available by the manufacturer, the testing laboratory, or by a third party.
3. Commissioning Testing
 - a. For Generating Facilities that incorporate certified equipment that have, at a minimum, passed the type tests and production tests described in California Rule 21 and are judged to have little or no potential impact on the District's Distribution System, it is necessary to perform only the following tests:
 - 1) Protective function settings that have been changed after production testing will require field verification. Tests shall be performed using injected secondary frequencies, voltages and currents, applied waveforms, at a test connection using a generator to simulate abnormal utility voltage or frequency, or varying the set points to show that the device trips at the measured (actual) utility voltage or frequency.
 - 2) The Non-Islanding function will be checked by operating a load break disconnect switch to verify the interconnection equipment ceases to energize the District's Distribution System and does not re-energize it for the required time delay after the switch is closed.
 - 3) The Non-Exporting function shall be checked using secondary injection techniques. This function may also be tested by adjusting the Generating Facility output and local loads to verify that the applicable Non-Exporting criteria (i.e., reverse power or under power) are met.
 - b. Additional commissioning testing, where required, will be performed on-site to verify protective settings and functionality. Upon initial parallel operation of a Generating Facility, or any time interface hardware or software is changed that may affect the functions listed below, a commissioning test must be performed. An individual, qualified in testing protective equipment (professional engineer, factory-certified technician, or licensed electrician with experience in testing protective equipment), must perform commissioning testing in accordance with the manufacturer's recommended test procedure to verify the settings and requirements per this Rule.
 - c. The District may require a written commissioning test procedure be submitted to the District at least ten (10) working days prior to the performance of the commissioning test. The District has the right to witness commissioning tests. The District may also require written certification by the installer describing which tests were performed and their results. Protective functions to be tested during commissioning may consist of the following:
 - Over and under-voltage
 - Over and under-frequency
 - Anti-Islanding function (if applicable)
 - Non-Exporting function (if applicable)
 - Inability to energize dead line
 - Time delay on restart after utility source is stable
 - Utility system fault detection (if used)
 - Synchronizing controls (if applicable)
 - Other interconnection protective functions that may be required as part of the Interconnection Agreement.Commissioning tests shall include visual inspections of the interconnection equipment and protective settings to confirm compliance with the interconnection requirements.
 - d. Other checks and tests that may need to be performed include:
 - Verifying final protective function settings
 - Trip test (Section M.3.f)
 - In-service test (Section M.3.g)

e. Verification of Settings

At the completion of the commissioning testing, the Producer shall confirm all devices are set to the District -approved settings. Approved settings should be displayed on each protective device. Verification shall be documented in the commissioning test certification.

f. Trip Tests

Interconnection protective functions and devices (e.g., reverse power relays) that have not previously been tested as part of the Interconnection Facilities with their associated interrupting devices (e.g., contactor or circuit breaker) shall be trip tested during commissioning. The trip test shall be adequate to prove that the associated interrupting devices open when the protective devices operate. Interlocking circuits between protective function devices or between interrupting devices shall be similarly tested unless they are part of a system that has been tested and approved during manufacturing.

g. In-Service Tests

Interconnection protective functions and devices that have not previously been tested as part of the Interconnection Facilities with their associated instrument transformers or that are wired in the field shall be given an in-service test during commissioning. This test will verify proper wiring, polarity, CT/PT ratios, and proper operation of the measuring circuits. The in-service test shall be made with the power system energized and carrying a known level of current. A measurement shall be made of the magnitude and phase angle of each Alternating Current (AC) voltage and current connected to the protective device and the results compared to expected values. For protective devices with built-in metering functions that report current and voltage magnitudes and phase angles, or magnitudes of current, voltage, and real and reactive power, the metered values may be used for in-service testing. Otherwise, portable ammeters, voltmeters, and phase-angle meters shall be used.

4. Periodic Testing

The Producer or applicant shall perform Periodic Testing of Interconnection-related Protective Functions as specified by the manufacturer, or at least every four (4) years. All periodic tests prescribed by the manufacturer shall be performed. The Producer or applicant shall maintain periodic test reports or a log for inspection by the District. Periodic testing conforming to the District test intervals for the particular Line Section may be specified by the District under special circumstances, such as high fire hazard areas. Batteries used to activate any protective function shall be checked and logged once per month for proper voltage. Once every four (4) years, these batteries must be either replaced or a discharge test must be performed.