NEW YORK STATE
STANDARDIZED INTERCONNECTION REQUIREMENTS, APPLICATION PROCESS, CONTRACT & APPLICATION FORMS FOR NEW DISTRIBUTED GENERATORS, 300 KILOVOLT - AMPERES OR LESS, CONNECTED IN PARALLEL WITH RADIAL DISTRIBUTION LINES

New York State
Public Service Commission
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I. Application Process

Application Process Steps for the Interconnection of New Distributed Generation Units of 300 kVA or Less Connected to Radial Distribution Lines

Introduction

This section provides a framework for processing applications to interconnect new distributed generation facilities with a nameplate rating of 300 kVA or less (aggregated on the customer side of the point of common coupling[3]) connected in parallel to radial distribution feeders.[4] Generation not operating in parallel is not subject to these requirements. This section will ensure that applicants are aware of the technical interconnection requirements and utility interconnection policies and practices. The section will also provide applicants with understanding of the process and information required to permit utilities to review and accept the applicants' equipment for interconnection in a reasonable and expeditious manner.

The time required to complete the process will reflect the complexity of the proposed project. Projects using previously-submitted designs that have been satisfactorily type tested[5] will move through the process more quickly, and several steps may be satisfied with an initial application depending on the detail and completeness of the application and supporting documentation submitted by the applicant. Applicants submitting type tested systems, however, are not exempt from providing utilities with complete design packages necessary for the utilities to verify the electrical characteristics of the generator systems, the interconnecting facilities, and the impacts of the applicants' equipment on the utilities' systems.

The application process and the attendant services must be offered on a non-discriminatory basis. The utilities must clearly identify their costs related to the applicants' interconnections, specifically those costs the utilities would not have incurred but for the applicants' interconnections. The utilities will keep a log of all applications, milestones met, and justifications for application-specific requirements. The applicants are to be responsible for payment of the utilities' costs, as provided for herein.

Staff of the Department of Public Service (Staff) will monitor the application process to ensure that applications are addressed in a timely manner. To perform this monitoring function, Staff will meet periodically with utility and applicant representatives.

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[3] See Glossary for definition.

[4] See Glossary for definition.

[5] See Glossary for definition.

Application Process Steps

STEP 1 - Initial Communication from the Potential Applicant.

Communication could range from a general inquiry to a completed application.

STEP 2 - The Inquiry is Reviewed by the Utility to Determine the Nature of the Project.

Technical staff from the utility discusses the scope of the project with the potential applicant (either by phone or in person) to determine what specific information and documents (such as an application, contract, technical requirements, specifications, listing of qualified type tested equipment/systems, application fee information, applicable rate schedules and metering requirements) will be provided to the potential applicant. The preliminary technical feasibility of the project at the proposed location may also be discussed at this time. All such information and a copy of the standardized interconnection requirements must be sent to the applicant within three (3) business days following the initial communication from the potential applicant, unless the potential applicant indicates otherwise. A utility representative will serve as the single point of contact for the applicant (unless the utility informs the applicant otherwise) in coordinating the potential applicant's project with the utility.

STEP 3 - Potential Applicant Files an Application.

The potential applicant files an application. The filing must include the completed standard application form and a non-refundable $350 application fee. There will be no application fee for units with a total rating of 15 kVA or less. (If the applicant proceeds with the project to completion, the application fee will be applied as a payment by the applicant to the utility's total cost for interconnection.) Within five (5) business days of receiving the application, the utility will notify the applicant of receipt and whether the application has been completed adequately. Several exchanges of information between the utility and applicant might occur until the application has been completed according to the standardized interconnection requirements.

STEP 4 - Utility Initiates a Coordinated Electric System Interconnection Review and Develops a Cost Estimate.

The utility initiates a Coordinated Electric System Interconnection Review[6] and informs the applicant of the utility's necessary system additions/modifications and of contractual requirements for interconnection. The utility will provide the

[6]See Glossary for definition.

applicant with a written assessment of the technical feasibility of the proposed interconnection, a preliminary schedule, and a good-faith, detailed estimate of the interconnection costs. Contract elements might include a parallel interconnection agreement, coverage of interconnection costs, requirements for design, and O&M specifications. A full Coordinated Electric System Interconnection Review will not be required in all instances.

A full Coordinated Electric System Interconnection Review may need to be performed by the utility to determine if the generation on the circuit results in any relay coordination, fault current, and/or voltage regulation problems. A full Coordinated Electric System Interconnection Review may not be needed if the aggregate generation is less than:

50 kVA on a single-phase branch of a radial distribution circuit; or

150 kVA on a single distribution feeder.

The utility should complete its Coordinated Electric System Interconnection Review within 4 weeks (20 business days) for the interconnection of units of 15 kVa or less and within 8 weeks (40 business days) for larger units.

The utilities will review application-screening processes, as they are developed nationally, to minimize the cost of these studies.

STEP 5 - Applicant Commits to the Utility's Review of the Applicant's Proposed Interconnection Design Package.

The applicant is required to:

- submit a detailed interconnection design package;

- provide the utility with a cost-based advance payment for the utility's reviews including for the Coordinated Electric System Interconnection Review not covered by the application fee and for the utility review of the proposed interconnection design package, and

- confirm with the utility a mutually agreeable schedule for the project based on the applicant's work plans and the discussions held in STEP 4.

It may take several exchanges of information between the utility and the applicant until the design package has been completed according to the technical requirements for interconnection.

STEP 6 - Utility Performs a Review of Applicant's Proposed Interconnection Design Package.

The utility will:

- conduct a review of the design package to ensure that the plans/design satisfy the goal of attaining a safe, reliable, and efficient interconnection and satisfy the technical requirements for interconnection;

- upon completion of the review, notify the applicant of its final acceptance of the applicant's design or an explanation of the technical requirements the design fails to meet. In addition, this notice will include any site-specific test requirements applicable to STEP 9.

For type tested systems, the utility will complete its review in ten (10) business days. For non-type tested systems the utility will complete its review in 4 weeks (20 business days).

STEP 7 - Applicant Commits to Utility Construction of Utility's System Modifications

The applicant will:

- execute a standardized interconnection contract; and

- provide the utility with an advance payment for the utility's estimated costs associated with system modifications, metering, and on-site verification. (Estimated costs will be reconciled with actual costs in Step 11.)

STEP 8 - Project Construction

The applicant will build the facility in accordance with the utility-accepted design. The utility will commence construction/installation of system modifications and metering requirements as identified in STEP 4.

Utility system modifications will vary in construction time depending on the extent of work and equipment required. The schedule for this work is to be discussed with the applicant in STEP 5.

STEP 9 - The Applicant's Facility is Tested in Accordance With the Standard Interconnection Requirements.

The applicant will develop a written testing plan to be submitted to the utility for review and acceptance. The test plan shall include the verification test procedure(s) published by the manufacturer(s) of the interconnection equipment. This testing plan will be designed to verify compliance of the facility with the applicant's utility-accepted drawings and details of the interconnection. The final

testing will include testing in accordance with the standardized interconnection requirements and the site-specific requirements identified by the utility in STEP 6. The final testing will be conducted at a mutually agreeable time, and the utility shall be given the opportunity to witness the tests.

STEP 10 - Interconnection

The applicant's facility will be allowed to commence parallel operation upon satisfactory completion of the tests in STEP 9. In addition, the applicant must have complied with and must continue to comply with the contractual and/or technical requirements.

STEP 11 - Final Acceptance and Utility Cost Reconciliation

Within a reasonable time after interconnection, the utility will review the results of its on-site verification and issue to the applicant a formal letter of acceptance for interconnection. The utility will also reconcile its actual costs related to the applicant's project against the application fee and advance payments made by the applicant. The applicant will receive either a bill for any balance due or a reimbursement for overpayment as determined by the utility's reconciliation. The applicant may contest the reconciliation.

II. Interconnection Requirements

A. Design Requirements

1. Common

The generator-owner shall provide appropriate protection and control equipment, including an interrupting device, that will disconnect[7] the generation in the event that the portion of the utility system that serves the generator is de-energized for any reason or for a fault in the generator-owner's system. The generator-owner's protection and control equipment shall be capable of disconnecting the generation upon detection of an islanding[8] condition and upon detection of a utility system fault.

The generator-owner's protection and control scheme shall be designed to allow the generation, at steady state, to operate only within the limits specified in this document for frequency and voltage. Upon request from the utility, the generator-owner shall provide documentation detailing compliance with the requirements set forth in this document.

The specific design of the protection, control and grounding schemes will depend on the size and characteristics of the generator-owner's generation, as well the generator-owner's load level, in addition to the characteristics of the particular portion of the utility's system where the generator-owner is interconnecting.

The generator-owner shall have, as a minimum, an interrupting device(s) sized to meet all applicable local, state and federal codes and operated by over and under voltage protection on each phase. The interrupting device(s) shall also be operated by over and under frequency protection on at least one phase. All phases of a generator or inverter interface shall disconnect for a voltage or frequency trip on any phase. It is recommended that voltage protection be wired phase to ground.

- The interrupting device shall automatically initiate a disconnect sequence from the utility system within six (6) cycles if the voltage falls below 60 V rms phase to ground (nominal 120 V rms base) on any phase.

- The interrupting device shall automatically initiate a disconnect sequence from the utility system within two (2) seconds if the voltage rises above 132 V rms phase to ground or falls below 106 V rms phase to ground (nominal 120 V rms base) on any phase.

[7] See Glossary for definition.

[8] Ibid.

- The interrupting device shall automatically initiate a disconnect sequence from the utility system within two (2) cycles if the voltage rises above 165 V rms phase to ground (nominal 120 V rms base) on any phase.

- The interrupting device shall automatically initiate a disconnect sequence from the utility system within six (6) cycles if the frequency rises above 60.5 Hz or falls below 59.3 Hz.

The need for additional protection equipment shall be determined by the utility on a case-by-case basis. The utility shall specify and provide settings for those relays that the utility designates as being required to satisfy protection practices. Any protective equipment or setting specified by the utility shall not be changed or modified at any time by the generator-owner without written consent from the utility.

To avoid out-of-phase reclosing, the design of the generator-owner's protection and control scheme shall take into account the utility practice of automatically reclosing the feeder without synchronism check as quickly as 12 cycles after being tripped.

The generator-owner shall be responsible for ongoing compliance with all applicable local, state and federal codes and standardized interconnection requirements as they pertain to the interconnection of the generating equipment.

Protection shall not share electrical equipment associated with utility revenue metering.

A failure of the generator-owner's interconnection protection equipment, including loss of control power, shall open the interrupting device, thus disconnecting the generation from the utility system. A generator-owner's protection equipment shall utilize a non-volatile memory design such that a loss of internal or external control power, including batteries, will not cause a loss of interconnection protection functions or loss of protection set points.

All interface protection and control equipment shall operate as specified independent of the calendar date.

2. Synchronous Generators

Synchronous generation shall require synchronizing facilities. These shall include automatic synchronizing equipment or manual synchronizing with relay supervision, voltage regulator and power factor control.

3. Induction Generators

Induction generation may be connected and brought up to synchronous speed (as an induction motor) if it can be demonstrated that the initial voltage drop measured at the point of common coupling (PCC)[9] is acceptable based on current inrush limits. The same requirements also apply to induction generation connected at or near synchronous speed because a voltage dip is present due to an inrush magnetizing current. The generator-owner shall submit the expected number of starts per specific time period and maximum starting kVA draw data to the utility to verify that the voltage dip due to starting is within the visible flicker limits as defined by IEEE 519-1992, Recommended Practices and Requirements for Harmonic Control in Electric Power Systems (IEEE 519) .

Starting or rapid load fluctuations on induction generators can adversely impact the utility's system voltage. Corrective step-switched capacitors or other techniques may be necessary. These measures can, in turn, cause ferroresonance. If these measures (additional capacitors) are installed on the customer's side of the PCC, the utility will review these measures and may require the customer to install additional equipment.

4. DC Inverters

Direct current generation can only be installed in parallel with the utility's system using a synchronous inverter. The design shall be such as to disconnect this synchronous inverter upon a utility system interruption.

Line-commutated inverters do not require synchronizing equipment if the voltage drop is determined to be acceptable, as defined in Section IV(E), Power Quality, of this document. Self-commutated inverters of the utility-interactive type shall synchronize to the utility. Stand-alone, self-commutated inverters shall not be used for parallel operation with the utility.

A line inverter can be used to isolate the customer from the utility system provided it can be demonstrated that the inverter isolates the customer from the utility system safely and reliably.

Voltage and frequency trip set points for inverters shall be accessible to service personnel only.

[9] See Glossary for definition.

5. Metering

The need for additional revenue metering or modifications to existing metering will be reviewed on a case-by-case basis and shall be consistent with metering requirements adopted by the Public Service Commission.

B. Operating Requirements

The generator-owner shall provide a 24-hour telephone contact(s). This contact will be used by the utility to arrange access for repairs, inspection or emergencies. The utility will make such arrangements (except for emergencies) during normal business hours.

The generator-owner shall not supply power to the utility during any outages of the system that serves the PCC. The generator-owner's generation may be operated during such outages only with an open tie to the utility. Islanding will not be permitted. The generator-owner shall not energize a de-energized utility circuit for any reason.

Generation that does not operate in parallel with the utility's system is not subject to these requirements.

The disconnect switch[10] specified in Section IV(D) of this document may be opened by the utility at any time for any of the following reasons:

a. To eliminate conditions that constitute a potential hazard to utility personnel or the general public;
b. Pre-emergency or emergency conditions on the utility system;
c. A hazardous condition is revealed by a utility inspection;
d. Protective device tampering.

The disconnect switch may be opened by the utility for the following reasons, after notice to the responsible party has been delivered and a reasonable time to correct (consistent with the conditions) has elapsed:

a. A power producer has failed to make available records of verification tests and maintenance of its protective devices;
b. A power producer's system interferes with utility equipment or equipment belonging to other utility customers;
c. A power producer's system is found to affect quality of service of adjoining customers.

[10] See Glossary for definition.

The utility will provide a name and telephone number so that the customer can obtain information about the utility lock-out. The customer shall be allowed to disconnect from the utility without prior notice in order to self-generate.

Following a generation facility disconnect as a result of a voltage or frequency excursion, the generation facility shall remain disconnected until the utility's service voltage and frequency has recovered to the utility's acceptable voltage and frequency limits for a minimum of five (5) minutes.

A utility may require direct transfer trip (DTT)[11] whenever: 1) the minimum load to generation ratio on a circuit is such that a ferroresonance condition could occur; 2) it is determined that the customer's protective relaying may not operate for certain conditions or faults and/or 3) the installation could increase the length of outages on a distribution circuit or jeopardize the reliability of the circuit. The utility will be required to demonstrate the need for DTT.

C. Dedicated Transformer[12]

The connecting utility reserves the right to require a power producing facility to connect to the utility system through a dedicated transformer. The transformer shall either be provided by the connecting utility at the generator-owner's expense, purchased from the utility, or conform to the connecting utility's specifications. The transformer may be necessary to ensure conformance with utility safe work practices, to enhance service restoration operations or to prevent detrimental effects to other utility customers. The dedicated transformer that is part of the normal electrical service connection of a generator-owner's facility may meet this requirement if there are no other customers supplied from it. A dedicated transformer is not required if the installation is designed and coordinated with the utility to protect the utility system and its customers adequately from potential detrimental net effects caused by the operation of the generator.

If the utility determines a need for a dedicated transformer, it shall notify the generator-owner in writing of the requirements. The notice shall include a description of the specific aspects of the utility system that necessitate the addition, the conditions under which the dedicated transformer is expected to enhance safety or prevent detrimental effects, and the expected response of a normal, shared transformer installation to such conditions.

[11] See Glossary for definition.

[12] See Glossary for definition.

D. Disconnect Switch

Generating equipment shall be capable of being isolated from the utility system by means of an external, manual, visible, gang-operated, load break disconnecting switch. The disconnect switch shall be installed, owned and maintained by the owner of the power producing facility and located between the power producing equipment and its interconnection point with the utility system.

The disconnect switch must be rated for the voltage and current requirements of the installation.

The basic insulation level (BIL) of the disconnect switch shall be such that it will coordinate with that of the utility's equipment. Disconnect devices shall meet applicable UL, ANSI and IEEE standards, and shall be installed to meet all applicable local, state and federal codes. (New York City Building Code may require additional certification.)

The disconnect switch shall be clearly marked, "Generator Disconnect Switch", with permanent 3/8 inch letters or larger.

The disconnect switch shall be located within 10 feet of the utility's external electric service meter, or the location and nature of the distributed power disconnection switches shall be indicated in the immediate proximity of the electric service entrance.

The disconnect switch shall be readily accessible for operation and locking by utility personnel in accordance with Section IV(B) of this document.

The disconnect switch must be lockable in the open position with a standard utility padlock with a 3/8 inch shank.

E. Power Quality

The maximum harmonic limits for electrical equipment shall be in accordance with IEEE 519. The objective of IEEE 519 is to limit the maximum individual frequency voltage harmonic to 3% of the fundamental frequency and the voltage Total Harmonic Distortion (THD) to 5% on the utility side of the PCC. In addition, any voltage flicker resulting from the connection of the customer's energy producing equipment to the utility system must not exceed the limits defined by the maximum permissible voltage fluctuations border line of visibility curve, Figure 10.3 identified in IEEE 519. This requirement is necessary to minimize the adverse voltage effect upon other customers on the utility system.

F. Power Factor

If the power factor, as measured at the PCC, is less than 0.9 (leading or lagging), the method of power factor correction necessitated by the installation of the generator will be negotiated with the utility as a commercial item.

Induction power generators may be provided VAR capacity from the utility system at the generator-owner's expense. The installation of VAR correction equipment by the generator-owner on the generator-owner's side of the PCC must be reviewed and approved by the interconnecting utility prior to installation.

G. Islanding

Generation interconnection systems must be designed and operated so that islanding is not sustained on radial distribution circuits. The requirements listed in this document are designed and intended to prevent islanding.

H. Test Requirements

This section is divided into type testing and verification testing. Type testing is performed or witnessed once by an independent testing laboratory for a specific protection package. Once a package meets the type test criteria described in this section, the design is accepted by all New York State utilities. If any changes are made to the hardware, software, firmware, or verification test procedures, the manufacturer must notify the independent testing laboratory to determine what, if any, parts of the type testing must be repeated. Failure of the manufacturer to notify the independent test laboratory of changes may result in withdrawal of approval and disconnection of units installed since the change was made. Verification testing is site-specific, periodic testing to assure continued acceptable performance.

Type testing results shall be reported to the New York State Department of Public Service. Department staff shall review the test report to verify all the appropriate tests have been performed. The Department of Public Service will maintain a list of equipment that has been type tested and approved for interconnection in New York State. The list will contain discrete protective relays as well as inverters with integrated protection and control. The list will indicate specific model numbers and firmware versions approved. The equipment in the field must have a nameplate that clearly shows the model number and firmware version (if applicable).

These test procedures apply only to devices and packages associated with protection of the interface between the generating system and the utility. Interface protection is usually limited to voltage relays, frequency relays, synchronizing relays, reverse current or power relays, and anti-islanding schemes. Testing of relays or devices associated specifically with protection or control of generating equipment is recommended, but not required unless they impact the interface protection.

At the time of production, all interconnecting equipment including inverters and discrete relays must meet or exceed the requirements of ANSI/IEEE C62.41-1991 - Recommended Practices on Surge Voltages in Low Voltage AC Power Circuits or C37.90.1 1989, IEEE Standard Surge Withstand Capability (SEC) Tests for Protective Relays and Relay Systems. If C62.41-1991 is used, the surge types and parameters shall be applied, as applicable, to the equipment's intended insulation location. If the

device is not tested to level C voltage, i.e., for an intended location on the utility side of the meter, the test report shall record the voltage level to which the device was tested and the Public Service Commission listing shall specify the location limitations of the device.

If after the application of the surge test, the unit is still functioning and has the capability to export power to the utility, it shall be subjected to and comply with the manufacturer's verification test and the appropriate dielectric test as specified in UL 1741.

All single-phase and three phase test voltages shall be applied phase to ground.[13]

Isolation transformers specified as required or listed as optional must be connected. Each optional isolation transformer connection constitutes a separate type test. Generic isolation transformers may be substituted after type testing.

Three-phase isolation transformers connected wye-grounded/delta on the generator side are not permitted.

1. Type Testing

All interface equipment must include a verification test procedure as part of the documentation. Except for the case of small single-phase inverters discussed below, the verification test must determine if protection settings meet these requirements. The independent testing laboratory shall conduct the verification test prescribed by the manufacturer to determine if the verification test procedure adequately demonstrates compliance with these requirements.

Prior to testing, all batteries shall be disconnected or removed for a minimum of ten (10) minutes. This test is to verify the system has a non-volatile memory and that protection settings are not lost. A test shall also be performed to determine that failure of any battery not used to supply trip power will result in an automatic shutdown.

a. Single-Phase Inverters

All single-phase inverters shall be non-islanding inverters as defined by IEEE P929. Inverters 10kW and below shall at the time of production meet or exceed the requirements of IEEE 929 and UL 1741. Specifically, the inverter shall automatically disconnect for an islanding condition with load quality factor of 2.5 within two (2) seconds. In addition, all single-phase inverters and single-phase voltage and frequency

[13]Test voltages are specified phase to ground for a 120 volt nominal system. Other system voltages require adjusting the test voltages by the appropriate percentage. Over and undervoltage protection should be wired phase to ground. Phase to phase voltage sensing results in less sensitive undervoltage detection and more sensitive overvoltage detection.

relay packages shall initiate a trip from a waveform generator for the waveforms listed below to verify they meet the requirements set forth in the design section of this document.

Waveform 1 A 120 V rms 60 Hz sinusoidal that drops in voltage to 59 V rms for six (6) cycles beginning and ending at a zero crossing and resuming to 120 V rms for five minutes.

Waveform 2 A 120 V rms 60 Hz sinusoidal that drops in voltage to 105 V rms for 120 cycles beginning and ending at a zero crossing and resuming to 120 V rms for five minutes.

Waveform 3 A 120 V rms 60 Hz sinusoidal that rises in voltage to 133 V rms for 120 cycles beginning and ending at a zero crossing and resuming to 120 V rms for five minutes.

Waveform 4 A 120 V rms 60 Hz sinusoidal that rises in voltage to 166 volts for two (2) cycles beginning and ending at a zero crossing and resuming to 120 V rms for five minutes.

Waveform 5 A 120 V rms 60 Hz sinusoidal that drops in frequency to 59.2 Hz for six (6) cycles beginning and ending at a zero crossing and resuming to 60 Hz for five minutes.

Waveform 6 A 120 V rms 60 Hz sinusoidal that rises in frequency to 60.6 Hz for six (6) cycles beginning and ending at a zero crossing and resuming to 60 Hz for five minutes.

Each waveform test shall be repeated ten (10) times. Failure to cease to export power for any one run constitutes failure of the test. These tests shall also verify the inverter or power producing facility shall not automatically reconnect to the waveform generator until after five (5) minutes of continuous normal voltage and frequency. The manufacturer may supply a special production sample with the five minute reset timer disabled to eliminate waiting time during type testing. At least one test must be performed on a sample with a five minute reset timer to verify the function and accuracy of the timer.

b. Three-Phase Inverters

Three-phase inverters and discrete three-phase voltage relays shall be type tested with three phase waveforms. The inverter shall disconnect or the protection equipment shall initiate a trip from the waveform generator for each of the waveforms described below:

Waveform 1 A three-phase sinusoidal operating at 60 Hz and 120 V rms interrupted by phase A voltage depressed to 59 V rms for six (6) cycles

beginning and ending at a zero crossing while B and C phases continue at 120 V rms. Repeat the same test with B phase depressed, with C phase depressed, with A and B phases depressed, with B and C phases depressed, and finally with all phases depressed to 59 V for six cycles.

Waveform 2 A three-phase sinusoidal operating at 60 Hz and 120 V rms interrupted by phase A voltage depressed to 59 V rms for six (6) cycles beginning and ending at a zero crossing while B and C phases are increased to 150 V rms beginning and ending at the same point of discontinuity. Repeat the same test with B phase depressed and A and C phases increased and with C phase depressed and A and B phases increased.

Waveform 3 A three-phase sinusoidal operating at 60 Hz and 120 V rms interrupted by phase A voltage depressed to 105 V rms for two seconds (120 cycles) beginning and ending at a zero crossing while B and C phases continue at 120 V rms. Repeat the same test with B and C phases depressed to the same level and for the same duration.

Waveform 4 A three-phase sinusoidal operating at 60 Hz and 120 V rms interrupted by phase A voltage increased to 133 V rms for two seconds (120 cycles) beginning and ending at a zero crossing while B and C phases continue at 120 V rms. Repeat the same test with B and C phases increased to the same level and for the same duration.

Waveform 5 A three-phase sinusoidal operating at 60 Hz and 120 V rms interrupted by phase A voltage increased to 166 V rms for two seconds (120 cycles) beginning and ending at a zero crossing while B and C phases continue at 120 V rms. Repeat the same test with B and C phases increased to the same level and for the same duration.

Waveform 6 A three-phase sinusoidal operating at 60 Hz and 120 V rms interrupted by phase A voltage increased to 166 V rms for two cycles beginning and ending at a zero crossing while B and C phases are decreased to 100 V rms beginning and ending at the same point of discontinuity. Repeat the same test with B phases increased and A and C phases decreased and for C phase increased and A and B phases decreased to the same levels and for the same duration.

Waveform 7 A three phase sinusoidal operating at 60 Hz and 120 V rms interrupted with six (6) cycles of 59.2 Hz beginning and ending at the zero crossing on A phase.

Waveform 8 A three-phase sinusoidal operating at 60 Hz and 120 V rms interrupted with six (6) cycles of 59.2 Hz beginning and ending at the zero

crossing on B phase and with A and C phase voltages depressed to 70 V rms beginning and ending at the same point of discontinuity.

Waveform 9 A three-phase sinusoidal operating at 60 Hz and 120 V rms interrupted with six (6) cycles of 60.6 Hz beginning and ending at the zero crossing on A phase.

Waveform 10 A three-phase sinusoidal operating at 60 Hz and 120 V rms interrupted with six (6) cycles of 60.6 Hz beginning and ending at the zero crossing on C phase and with A and B phase voltage depressed to 70 V rms beginning and ending at the same point of discontinuity.

Each three-phase waveform test shall be repeated ten (10) times. Failure to trip for any one run constitutes failure of the test. These tests shall also verify the inverter or power producing facility shall not automatically reconnect to the waveform generator until after five (5) minutes of continuous normal voltage and frequency. The manufacturer may supply a special production sample with the five minute reset timer disabled to eliminate waiting time during type testing. At least one test must be performed on a sample with a five minute reset timer to verify the function and accuracy of the timer.

Alternatively, three-phase inverters with integrated protection and control may be tested with a generator to simulate abnormal utility frequency and voltages. Abnormal utility voltage may also be simulated with an autotransformer/variac. The tests shall include:

Test 1: With the generator and inverter output stabilized at 60 Hz and 120 V rms and the inverter output between 0.5 and 1.0 per unit power, ramp the generator voltage up to 133 V rms at a rate no greater than 5 volts per second. Measure and record the frequency and voltage. The frequency must remain within 0.2 Hz of 60 Hz and the voltage may not exceed 137 V rms. The inverter must cease to export power within two seconds (120 cycles) of the first half-cycle reaching 188 V peak to neutral. Repeat the test with the inverter output below 0.1 per unit power.

Test 2: Insert a tapped transformer and a breaker between A phase of the generator and A phase of the inverter arranged such that when the breaker is opened or closed, A phase of the inverter receives half the voltage of the generator. With the generator and inverter output stabilized at 60 Hz and 119 V rms and the inverter output between 0.5 and 1.0 per unit power, operate the breaker so A phase of the inverter only receives 58 V rms. Measure and record the frequency and voltage. The frequency must remain within 0.2 Hz of 60 Hz and the voltage may not drop below 55 V rms on A phase of the inverter or below 110 V rms on B or C phases of the inverter. The inverter must cease to export power within six cycles of when the first half cycle of voltage on A phase of the inverter drops

below 83 V peak to neutral. Repeat the test applying half voltage to B and C phases. And repeat the test for all phases with the inverter output below 0.1 per unit power.

Test 3: With the generator and inverter output stabilized at 60 Hz and 120 V rms and the inverter output between 0.5 and 1.0 per unit power, ramp the generator voltage down to 103 V rms at a rate no greater than 5 volts per second. Measure and record the frequency and voltage. The frequency must remain within 0.2 Hz of 60 Hz and the voltage must not drop below 99 V rms. The inverter must cease to export power within two seconds (120 cycles) of the first half-cycle reaching 145 V peak to neutral. Repeat the test with the inverter output below 0.1 per unit power.

Test 4: Insert a tapped transformer and a breaker between A phase of the generator and A phase of the inverter arranged such that when the breaker is opened or closed, A phase of the inverter receives four-fifths the voltage of the generator. With the generator and inverter output stabilized at 60 Hz and 128 V rms and the inverter output between 0.5 and 1.0 per unit power, operate the breaker so that A phase of the inverter only receives 103 V rms. Measure and record the frequency and voltage. The frequency must remain within 0.2 Hz of 60 Hz and the voltage may not drop below 99 V rms on A phase of the inverter, or below 110 V rms on B or C phases of the inverter. The inverter must cease to export power within two seconds (120 cycles) of when the first half cycle of voltage on A phase of the inverter drops below 145 V peak to neutral. Repeat the test applying low voltage to B and C phases. And repeat the test for all phases with the inverter output below 0.1 per unit power.

Test 5: With the generator and inverter output stabilized at 60 Hz and 120 V rms and the inverter output between 0.5 and 1.0 per unit power, ramp the generator frequency up to 60.6 Hz at a rate no greater than 0.5 Hz per second. Measure and record the frequency and voltage. The voltage must remain between 115 V rms and 125 V rms and the frequency must not exceed 60.8 Hz. The inverter must cease to export power within six cycles of the frequency exceeding 60.6 Hz (8.25 ms between zero crossings). Repeat the test with the inverter output below 0.1 per unit power.

Test 6: With the generator and inverter output stabilized at 60 Hz and 120 V rms and the inverter output between 0.5 and 1.0 per unit power, ramp the generator frequency down to 59.2 Hz at a rate no greater than 0.5 Hz per second. Measure and record the frequency and voltage. The voltage must remain between 115 V rms and 125 V rms and the frequency must not fall below 59.0 Hz. The inverter must cease to export power within six cycles of the frequency falling below 59.2 Hz (8.22 ms between zero

crossings). Repeat the test with the inverter output below 0.1 per unit power.

Test 1 through 6 above shall be repeated five (5) times. Failure to cease to export power for any one run where the frequency and voltage are recorded and fall outside of the accepted limits shall constitute failure of the test. Following at least one run of each test group, the generator is to remain running to verify that the inverter does not automatically reconnect until after five (5) minutes of continuous normal voltage and frequency.

It is not necessary to perform the 165 V rms test, the 132 V rms unbalanced voltage test, or the anti-islanding test on three phase inverters.

2. Verification Testing

Upon initial parallel operation of a generating system, or any time interface hardware or software is changed, a verification test must be performed. A licensed professional engineer or otherwise qualified individual must perform verification testing in accordance with the manufacturer's published test procedure. Qualified individuals include professional engineers, factory trained and certified technicians, and licensed electricians with experience in testing protective equipment. The utility reserves the right to witness verification testing or require written certification that the testing was performed.

Verification testing shall be performed every four years. All verification tests prescribed by the manufacturer shall be performed. If wires must be removed to perform certain tests, each wire and each terminal must be clearly and permanently marked. The generator-owner shall maintain verification test reports for inspection by the connecting utility.

Single-phase inverters rated 15 kVA and below may be verified once per year as follows: once per year, the owner or his agent shall operate the load break disconnect switch and verify the power producing facility automatically shuts down and does not restart for five minutes after the switch is closed. The owner shall maintain a log of these operations for inspection by the connecting utility.

Any system that depends upon a battery for trip power shall be checked and logged once per month for proper voltage. Once every four (4) years the battery must be either replaced or a discharge test performed.

III. **Glossary of Terms**

Automatic Disconnect Device An electronic or mechanical switch used to isolate a circuit or piece of equipment from a source of power without the need for human intervention.

Coordinated Interconnection Review - Any studies performed by utilities to ensure that the safety and reliability of the electric grid with respect to the interconnection of distributed generation as discussed in this document.

Dedicated Service Transformer or Dedicated Transformer A transformer with a secondary winding that serves only one customer.

Direct Transfer Trip (DTT) - remote operation of a circuit breaker by means of a communication channel.

Disconnect (verb) - to isolate a circuit or equipment from a source of power. If isolation is accomplished with a solid state device, "Disconnect" shall mean to cease the transfer of power.

Disconnect Switch A mechanical device used for isolating a circuit or equipment from a source of power.

Energy Conversion Device A machine or solid state circuit for changing direct current to alternating current or a machine that changes shaft horsepower to electrical power.

Islanding A condition in which a portion of the utility system that contains both load and distributed generation is isolated from the remainder of the utility system. [Adopted from IEEE 929, draft 9].

Point of Common Coupling (PCC) The point at which the electric utility and the customer interface occurs. Typically, this is the customer side of the utility revenue meter. [Adopted from IEEE 929, draft 9].

Radial Feeder A distribution line that branches out from a substation and is normally not connected to another substation or another circuit sharing the common supply.

Type Test - A test performed or witnessed once by a qualified independent testing laboratory for a specific protection package or device to determine whether the requirements of this document are met. The Type Test will typically be sponsored by equipment manufacturers.

Verification Test - A test performed upon initial installation and repeated periodically to determine that there is continued acceptable performance.

NEW YORK STATE
STANDARDIZED CONTRACT
FOR INTERCONNECTION OF NEW DISTRIBUTED GENERATION UNITS
WITH CAPACITY OF 300 kVA OR LESS TO BE OPERATED IN PARALLEL

Customer Information:	**Company Information:**
Name: _____	Name: _____
Address: _____	Address: _____
Telephone: _____	Telephone: _____

Unit Application No. _____

DEFINITIONS

Dedicated Facilities means the equipment and facilities on the Company's system necessary to permit operation of the Unit in parallel with the Company's system.

Delivery Service" means the services the Company may provide to deliver capacity or energy generated by Customer to a buyer to a delivery point(s), including related ancillary services.

"SIR means the New York State standardized interconnection requirements for new distributed generation units with a nameplate capacity of 300 kVA or less to be operated in parallel with the Company's radial system on radial distribution feeders.

"Unit" means the distributed generation unit with a nameplate capacity of less than 300 kVA located on the Customer's premises at the time the Company approves such unit for operation in parallel with the Company's system. This Agreement relates only to such Unit, but a new agreement shall not be required if the Customer makes physical alterations to the Unit that do not result in an increase in its nameplate generating capacity. The nameplate generating capacity of the Unit shall not exceed 300 kVA.

I. TERM AND TERMINATION

1.1 Term: This Agreement shall become effective when executed by both Parties and shall continue in effect until terminated.

1.2 Termination: This Agreement may be terminated as follows:

a. The Customer may terminate this Agreement at any time, by giving the Company sixty (60) days' written notice.

b. Failure by the Customer to seek final acceptance by the Company within twelve (12) months after completion of the utility construction process described in the SIR shall automatically terminate this Agreement.

c. Either Party may, by giving the other Party at least sixty (60) days' prior written notice, terminate this Agreement in the event that the other Party is in default of any of the material terms and conditions of this Agreement. The terminating Party shall specify in the notice the basis for the termination and shall provide a reasonable opportunity to cure the default.

d. The Company may, by giving the Customer at least sixty (60) days' prior written notice, terminate this Agreement for cause. The Customer's non-compliance with an upgrade to the SIR, unless the Customer's installation is "grandfathered," shall constitute good cause.

1.3 Disconnection and Survival of Obligations: Upon termination of this Agreement the Unit will be disconnected from the Company's electric system. The termination of this Agreement shall not relieve either Party of its liabilities and obligations, owed or continuing at the time of the termination.

1.4 Suspension: This Agreement will be suspended during any period in which the Customer is not eligible for delivery service from the Company.

II. SCOPE OF AGREEMENT

2.1 Scope of Agreement: This Agreement relates solely to the conditions under which the Company and the Customer agree that the Unit may be interconnected to and operated in parallel with the Company’s system.

2.2 Electricity Not Covered: The Company shall have no duty under this Agreement to account for, pay for, deliver, or return in kind any electricity produced by the Facility and delivered into the Company’s System.

III. INSTALLATION, OPERATION AND MAINTENANCE OF UNIT

3.1 Compliance with SIR: Subject to the provisions of this Agreement, the Company shall be required to interconnect the Unit to the Company's system, for purposes of parallel operation, if the Company accepts the Unit as in compliance with the SIR. The Customer shall have a continuing obligation to maintain and operate the Unit in compliance with the SIR.

3.2 Observation of the Unit - Construction Phase: The Company may, in its discretion and upon reasonable notice, conduct reasonable on-site verifications during the construction of the Unit. Whenever the Company chooses to exercise its right to conduct observations herein it shall specify to the Customer its reasons for its decision to conduct the observation. For purposes of this paragraph and paragraphs 3.3 through 3.5, the term "on-site verification shall not include testing of the Unit, and verification tests shall not be required except as provided in paragraphs 3.3 and 3.4.

3.3 Observation of the Unit - Fourteen-day Period: The Company may conduct on-site verifications of the Unit and observe the performance of verification testing within a reasonable period of time, not exceeding fourteen days, after receiving a written request from the Customer to begin producing energy in parallel with the Company's system. The Company may accept or reject the request, consistent with the SIR, based upon the verification test results.

3.4 Observation of the Unit - Post-Fourteen-day Period: If the Company does not perform an on-site verification of the Unit and observe the performance of verification testing within the fourteen-day period, the Customer may begin to produce energy after certifying to the Company that the Unit has been tested in accordance with the verification testing requirements of the SIR and has successfully completed such tests. After receiving the certification, the Company may conduct an on-site verification of the Unit and make reasonable inquiries of the Customer, but only for purposes of determining whether the verification tests were properly performed. The Customer shall not be required to perform the verification tests a second time, unless irregularities appear in the verification test report or there are other objective indications that the tests were not properly performed in the first instance.

3.5 Observation of the Unit - Operations: The Company may conduct on-site verification of the operations of the Unit after it commences operations if the Company has a reasonable basis for doing so based on its responsibility to provide continuous and reliable utility service or as authorized by the provisions of the Company's Retail Tariff relating to the verification of customer installations generally.

3.6 Costs of Dedicated Facilities: During the term of this Agreement, the Company shall design, construct and install the Dedicated Facilities. The Customer shall be responsible for paying the incremental capital cost of such Dedicated Facilities attributable to the Customer's Unit. All costs associated with the operation and maintenance of the

Dedicated Facilities after the Unit first produces energy shall be the responsibility of the Company.

IV. DISCONNECTION OF THE UNIT

4.1 Emergency Disconnection: The Company may disconnect the Unit, without prior notice to the Customer (a) to eliminate conditions that constitute a potential hazard to Company personnel or the general public; (b) if pre-emergency or emergency conditions exist on the Company system; (c) if a hazardous condition relating to the Unit is observed by a utility inspection; or (d) if the Customer has tampered with any protective device. The Company shall notify the Customer of the emergency if circumstances permit.

4.2 Non-Emergency Disconnection: The Company may disconnect the Unit, after notice to the responsible party has been provided and a reasonable time to correct, consistent with the conditions, has elapsed, if (a) the Customer has failed to make available records of verification tests and maintenance of his protective devices; (b) the Unit system interferes with Company equipment or equipment belonging to other customers of the Company; (c) the Unit adversely affects the quality of service of adjoining customers.

4.3 Disconnection by Customer: The Customer may disconnect the Unit at any time.

4.4 Utility Obligation to Cure Adverse Effect: If, after the Customer meets all interconnection requirements, the operations of the Company are adversely affecting the performance of the Unit or the Customer's premises, the Company shall immediately take appropriate action to eliminate the adverse effect. If the Company determines that it needs to upgrade or reconfigure its system the Customer will not be responsible for the cost of new or additional equipment beyond the point of common coupling between the Customer and the Company.

V. ACCESS

5.1 Access to Premises: The Company shall have access to the disconnect switch of the Unit at all times. At reasonable hours and upon reasonable notice consistent with Section III of this Agreement, or at any time without notice in the event of an emergency (as defined in paragraph 4.1), the Company shall have access to the Premises.

5.2 Company and Customer Representatives: The Company shall designate, and shall provide to the Customer, the name and telephone number of a representative or representatives who can be reached at all times to allow the Customer to report an emergency and obtain the assistance of the Company. For the purpose of allowing access to the premises, the Customer shall provide the Company with the name and telephone number of a person who is responsible for providing access to the Premises.

5.3 Company Right to Access Company-Owned Facilities and Equipment: If necessary for the purposes of this Agreement, the Customer shall allow the Company access to the Company's equipment and facilities located on the Premises. To the extent that the Customer does not own all or any part of the property on which the Company is required to locate its equipment or facilities to serve the Customer under this Agreement, the Customer shall secure and provide in favor of the Company the necessary rights to obtain access to such equipment or facilities, including easements if the circumstances so require.

VI. DISPUTE RESOLUTION

6.1 Good Faith Resolution of Disputes: Each Party agrees to attempt to resolve all disputes arising hereunder promptly, equitably and in a good faith manner.

6.2 Mediation: If a dispute arises under this Agreement, and if it cannot be resolved by the Parties within ten (10) working days after written notice of the dispute, the parties agree to submit the dispute to mediation by a mutually acceptable mediator, in a mutually convenient location in New York State, in accordance with the then current CPR Mediation Procedure, or to mediation by a mediator provided by the New York Public Service Commission. The parties agree to participate in good faith in the mediation for a period of 90 days. If the parties are not successful in resolving their disputes through mediation, then the parties may refer the dispute for resolution to the New York Public Service Commission, which shall maintain continuing jurisdiction over this agreement.

6.3 Escrow: If there are amounts in dispute of more than two thousand dollars ($2,000), the Customer shall either place such disputed amounts into an independent escrow account pending final resolution of the dispute in question, or provide to the Company an appropriate irrevocable standby letter of credit in lieu thereof.

VII. INSURANCE

7.1 Disclosure: The Customer is not required to provide general liability insurance coverage as part of this Agreement, the SIR, or any other Company requirement. Due to the risk of incurring damages, the Public Service Commission recommends that every distributed generation customer protect itself with insurance, and requires insurance disclosure as a part of this Agreement. The Customer hereby discloses as follows:

(Note: Check off one of the boxes below.)

[ ] the Customer has obtained, or already has in effect under an existing policy, general liability insurance coverage for operation of the Unit and intends to maintain such coverage for the duration of this Agreement (attach Certificate of Insurance or copy of Policy); or

[ ] the Customer has not obtained general liability insurance coverage for operation of the Unit and/or is self-insured.

7.2 Effect: The inability of the Company to require the Customer to provide general liability insurance coverage for operation of the Unit is not a waiver of any rights the Company may have to pursue remedies at law against the Customer to recover damages.

VIII. MISCELLANEOUS PROVISIONS

8.1 Third Parties: This Agreement is intended solely for the benefit of the parties hereto. Nothing in this Agreement shall be construed to create any duty to, or standard of care with reference to, or any liability to, any person not a party to this Agreement.

8.2 Severability: If any provision or portion of this Agreement shall for any reason be held or adjudged to be invalid or illegal or unenforceable by any court of competent jurisdiction, such portion or provision shall be deemed separate and independent, and the remainder of this Agreement shall remain in full force and effect.

8.3 Entire Agreement: This Agreement constitutes the entire Agreement between the parties and supersedes all prior agreements or understandings, whether verbal or written.

8.4 Waiver: No delay or omission in the exercise of any right under this Agreement shall impair any such right or shall be taken, construed or considered as a waiver or relinquishment thereof, but any such right may be exercised from time to time and as often as may be deemed expedient. In the event that any agreement or covenant herein shall be breached and thereafter waived, such waiver shall be limited to the particular breach so waived and shall not be deemed to waive any other breach hereunder.

8.5 Applicable Law: This Agreement shall be governed by and construed in accordance with the law of the State of New York.

8.6 Amendments: This Agreement shall not be amended unless the amendment is in writing and signed by the Company and the Customer.

8.7 Force Majeure: For purposes of this Agreement, "Force Majeure Event means any event: (a) that is beyond the reasonable control of the affected Party; and (b) that the affected Party is unable to prevent or provide against by exercising reasonable diligence, including the following events or circumstances, but only to the extent they satisfy the preceding requirements: acts of war, public disorder, insurrection, or rebellion; floods, hurricanes, earthquakes, lightning, storms, and other natural calamities; explosions or fires; strikes, work stoppages, or labor disputes; embargoes; and sabotage. If a Force Majeure Event prevents a Party from fulfilling any obligations under this Agreement, such Party will promptly notify the other Party in writing, and will keep the other Party informed on a continuing basis of the scope and duration of the Force Majeure Event. The affected Party will specify in reasonable detail the circumstances of the Force Majeure Event, its expected duration, and the steps that the affected Party is taking to mitigate the effects of the event on its performance. The affected Party will be entitled to suspend or modify its

performance of obligations under this Agreement, other than the obligation to make payments then due or becoming due under this Agreement, but only to the extent that the effect of the Force Majeure Event cannot be mitigated by the use of reasonable efforts. The affected Party will use reasonable efforts to resume its performance as soon as possible.

8.8 Assignment to Corporate Party: At any time during the term, the Customer may assign this Agreement to a corporation or other entity with limited liability, provided that the Customer obtains the consent of the Company. Such consent will not be withheld unless the Company can demonstrate that the corporate entity is not reasonably capable of performing the obligations of the assigning Customer under this Agreement.

8.9 Assignment to Individuals: At any time during the term, a Customer may assign this Agreement to another person, other than a corporation or other entity with limited liability, provided that the assignee is the owner, lessee, or is otherwise responsible for the Unit.

8.10 Permits and Approvals: Customer shall obtain all environmental and other permits lawfully required by governmental authorities prior to the construction and for the operation of the Unit during the term of this Agreement.

8.11 Limitation of Liability: Neither by inspection, if any, or non-rejection, nor in any other way, does the Company give any warranty, express or implied, as to the adequacy, safety, or other characteristics of any structures, equipment, wires, appliances or devices owned, installed or maintained by the Customer or leased by the Customer from third parties, including without limitation the Unit and any structures, equipment, wires, appliances or devices appurtenant thereto.

ACCEPTED AND AGREED:

Customer: _____

Date: _____

Company: _____

Date: _____

NEW YORK STATE STANDARIZED APPLICATION
FOR SINGLE PHASE ATTACHMENT OF PARALLEL
GENERATION EQUIPMENT 15 KVA OR SMALLER
TO THE ELECTRIC SYSTEM OF

Utility:_____

Customer:
Name: _____ Phone: (___)_____

Address:_____ Municipality: _____

_____

Consulting Engineer or Contractor:
Name: _____ Phone: (___)_____

Address:_____

_____

Estimated In-Service Date: _____

Existing Electric Service:
Capacity: _____Amperes Voltage: _____Volts
Service Character: ( )Single Phase ( )Three Phase

Location of Protective Interface Equipment on Property:
(include address if different from customer address)

_____

Energy Producing Equipment/Inverter Information:
Manufacturer: _____
Model No. _____ Version No. _____
( )Synchronous ( )Induction ( )Inverter ( )Other_____
Rating: _____kW Rating: _____kVA
Generator Connection: ( )Delta ( )Wye ( )Wye Grounded
Interconnection Voltage: _____Volts
System Type Tested (Total System): ( )Yes ( )No; attach product literature
Equipment Type Tested (i.e. Inverter, Protection System):
( )Yes ( )No; attach product literature
One Line Diagram attached: ( )Yes
Installation Test Plan attached: ( )Yes

Signature:

_____ _____ _____
CUSTOMER SIGNATURE TITLE DATE

NEW YORK STATE STANDARIZED APPLICATION
FOR ATTACHMENT OF PARALLEL GENERATION
EQUIPMENT 300 KVA OR SMALLER
TO THE ELECTRIC SYSTEM OF

Utility:_____

Customer:
Name: _____ Phone: (___)_____

Address:_____ Municipality: _____

_____

Consulting Engineer or Contractor:
Name: _____ Phone: (___)_____

Address:_____

_____

Estimated In-Service Date: _____

Existing Electric Service:
Capacity: _____Amperes Voltage: _____Volts
Service Character: ( )Single Phase ( )Three Phase
Secondary 3 Phase Transformer Connection ( )Wye ( )Delta

Location of Protective Interface Equipment on Property:
(include address if different from customer address)

_____

Energy Producing Equipment/Inverter Information:
Manufacturer: _____
Model No. _____ Version No. _____
( )Synchronous ( )Induction ( )Inverter ( )Other_____
Rating: _____kW Rating: _____kVA
Rated Output: ____VA Rated Voltage: ____Volts
Rate Frequency: ____Hertz Rated Speed: ____RPM
Efficiency: ____% Power Factor: ____%
Rated Current: ____Amps Locked Rotor Current: ____Amps
Synchronous Speed: ____RPM Winding Connection:
Min. Operating Freq./Time:
Generator Connection: ( )Delta ( )Wye ( )Wye Grounded
System Type Tested (Total System): ( )Yes ( )No; attach product literature
Equipment Type Tested (i.e. Inverter, Protection System):
( )Yes ( )No; attach product literature
One Line Diagram attached: ( )Yes
Installation Test Plan attached: ( )Yes

For Synchronous Machines:

Submit copies of the Saturation Curve and the Vee Curve
( )Salient ( )Non-Salient
Torque: _____lb-ft Rated RPM: _____
Field Amperes: _____ at rated generator voltage and current
and _____% PF over-excited
Type of Exciter: _____
Output Power of Exciter: _____
Type of Voltage Regulator: _____
Direct-axis Synchronous Reactance (X_d) _____ohms
Direct-axis Transient Reactance (X'_d) _____ohms
Direct-axis Sub-transient Reactance (X''_d) _____ohms

For Induction Machines:

Rotor Resistance (R_r)_____ohms Exciting Current ____Amps
Rotor Reactance (X_r)_____ohms Reactive Power Required:
Magnetizing Reactance (X_m)_____ohms ___VARs (No Load)
Stator Resistance (R_s)_____ohms ___VARs (Full Load)
Stator Reactance (X_s)_____ohms
Short Circuit Reactance (X''_d)_____ohms Phases:
Frame Size: _____ Design Letter: ____ ( )Single
Temp. Rise: _____^{O}C. ( )Three-Phase

For Inverters:

Manufacturer: _____ Model:
Type: ___ ( )Forced Commutated ( )Line Commutated
Rated Output: _____Amps _____Volts
Efficiency: _____%

Signature:

_____ _____ _____
CUSTOMER SIGNATURE TITLE DATE