

**Technical Considerations Covering Parallel Operations Of  
Nonresidential Customer Owned Generation of 500 Kilowatts or less and  
Interconnected with the Municipal Services Commission  
City of New Castle, Delaware Delivery System**

**Prerequisite** - The customer must first be in compliance with the tariff rules and regulations and the applicable tariff classification and rates. The terms and conditions contained herein are in addition to, but do not modify nor negate, the terms of the tariff.

**I Purpose** - The purpose of this document (relating to interconnection of on-site distributed generation and parallel generation requirements) is to clearly state the terms and conditions that govern the interconnection and parallel operation of on-site distributed generation, in order to:

- A. establish technical requirements which will promote the safe and reliable parallel operation of distributed generation resources:
- B. enhance the reliability of electric service:
- C. facilitate the implementation and use of distributed resources technologies:
- D. enhance economic efficiency in the production and consumption of electricity and other energy: and
- E. promote the use of distributed resources in order to provide electric system benefits during periods of capacity constraint

**II Applicability** - Unless otherwise provided, these guidelines apply to all nonresidential customer generation operating at 500 kilowatts or below which is interconnected at 12.5kV or below and operated in parallel with the MSC's power delivery system. Nonresidential generation shall be limited to 500kW or less.

**III Definitions**

- A. **Account** - An account is one metered or un-metered rate or service classification which has one electric delivery point of service. Each account shall have only one electric service supplier providing full electric supply requirements for that account. A premise may have more than one account.
- B. **Customer** - Any adult person, partnership, association, corporation, or other entity: (i) in whose name a service account is listed, (ii) who occupies or is the ratepayer for a premises, building, structure, etc., and (iii) who is primarily responsible for payment of bills. A customer includes anyone taking Delivery Service or combined Electric Supply & Delivery Service from the MSC under one service classification for one account, premises or site. Multiple premises or sites under the same name are considered multiple Customers.
- C. **Distributed Generation or On-Site Distributed Generation** - an electrical generating unit of less than or equal to 500 kW which may be connected in parallel operation to the MSC's system.
- D. **Generator Owner** - the owner of the generating system that is interconnected to the MSC.
- E. **Grid** - The interconnected arrangement of lines and transformers that make up the MSC's electric power system.

- F. **IEEE Standard 929** - IEEE Standard entitled *Recommended Practice for Utility Interface of Photovoltaic (PV) Systems*, P929 Draft 11, dated July, 1999, or subsequent approved revision thereof.
- G. **Interconnection** - the physical connection of distributed generation to the MSC's system in accordance with these guidelines so that parallel operation can occur.
- H. **Interconnection Application** - the standard form of application which must be submitted by the Generation Owner to the MSC for permission to interconnect with the MSC system. The approved Interconnection Application sets forth the contractual conditions under which the MSC and Generator Owner agree that one or more generating units whose aggregate generation at the Point of Common Coupling is less than or equal to 500kW may be interconnected at 12.5kV or less with the MSC's system.
- I. **Inverter** - A static power converter with control, protection and filtering functions that converts Direct Current input to Alternating Current output. Inverters must be of the non-islanding type.
- J. **Island** - A portion of the utility system which contains both load and distributed generation and is isolated from the remainder of the utility system.
- K. **MSC** - The Municipal Services Commission of the City of New Castle.
- L. **Parallel Operation** - Any electrical connection between the MSC's system and the Generator Owner's generating source.
- M. **Point of Common Coupling** - The point where the electrical conductors of the MSC system are connected to the Customer's conductors and where any transfer of electric power between the Generator Owner and the MSC System takes place (such as switchgear near the meter).
- N. **Pre-Approved Equipment** - Specific generating and protective equipment system or systems that have been approved by the MSC as meeting the applicable parts of this document.
- O. **Pre-Interconnection Study** - A study or studies which may be undertaken by the MSC in response to its receipt of a completed application for parallel operation with the MSC's system submitted on the Interconnected Application form prescribed by these guidelines. Pre-Interconnection Studies may include, but are not limited to service studies, coordination studies and facilities impact studies.
- P. **Qualifying Facility (QF)** - An electric generation facility which is a qualifying facility under Subpart " Section 201 of the Federal Energy Regulatory Commission's regulations per the Public Utility Regulatory Policies Act of 1978.
- Q. **Stabilized** - The MSC's system following a disturbance which returns to the normal range of voltage and frequency for at least 5 minutes or longer as coordinated with the MSC. The MSC may require a longer period upon a reasonable showing that the reconnection after 5 minutes will adversely affect the safety and reliability of the electric system.
- R. **Unit** - A distributed generation facility.
- S. **Utility System or Electric Distribution Facility** - MSC's distribution system operating at 12.5 kilovolts or below to which the generation equipment is interconnected.

IV **Interconnection Application** - A proposed Generator Owner will make a formal application to the MSC for the interconnection of a generator to the MSC system. The application will be made on an Application Form provided by the MSC.

- V. **Designation of MSC Contact Persons for Matters Relating to Distributed Generation Interconnection** - The MSC's Electric Supervisor will be the designated point of contact for all matters related to interconnected generation. The MSC will maintain records concerning applications received for interconnection and parallel operation of distributed generation. Such records will include the date of receipt of each application, documents generated in the course of processing such applications, correspondence regarding such applications and the final disposition of such application.
- VI **Pre-Interconnection Studies** - In many instances the MSC will wish to conduct a service study, coordination study, or facilities impact study prior to interconnection of a distributed generation unit. In instances where such studies are deemed necessary the scope of such studies shall be based on the characteristics of the particular distributed generation unit to be interconnected and the proposed point of interconnection.
- A. **Completion of Pre-interconnection Study** - Upon completion of the interconnection study, the MSC will notify the Generator Owner that his application has been approved or indicate where there is insufficient detail and why the application cannot be approved. The conducting of such pre-interconnection studies shall not unduly delay the interconnection of the distributed generation. In no event shall such studies take longer to complete than 4 weeks after receipt of signed customer application and customer submittal of all required data.
- B. **Pre-interconnection Study Fee** - The MSC will do a pre-interconnection study without charge up to the typical and customary cost that the MSC would expend for study work of similar type of customer interconnection. If the cost to the MSC is expected to exceed this typical and customary amount, or if multiple submittals by the Generator Owner are necessary, the MSC will advise the Generator Owner of the expected cost of such study work by the MSC before such work begins. The Generator Owner will be responsible for payment of all costs above the typical and customary amount.
- VII **Network Interconnection of Distributed Generation** - Where generation is to be connected to a network system and capable of exporting power to the Grid, the interconnection study may result in more stringent interconnection requirements.
- VIII **Pre-approval of Generation units, Devices and Systems** - Upon approval by the MSC that certain generating unit's protective devices and/or system(s) meet the standards set out in these guidelines, such approval shall be made available to the appropriate manufacturer upon written request. For subsequent applications using some or all of the identical generating unit's protective devices and/or systems, the manufacturer may submit a copy of the approval with the application as proof that its equipment has already been approved for use on the MSC's system. Use of preapproved equipment will not eliminate any applicable requirement for a pre-interconnection study to determine the suitability of the equipment for each application, given the unique arrangements and characteristics of both the Generator Owner and MSC systems at the point of the interconnection.
- IX **Connection Approval** - The Generator Owner can connect their generation to the MSC system only after the Interconnection Application has been approved and the Generation Owner has received approval notification.

- X Interconnected Generation Site Warning Label** - The Generator Owner will install a warning label in a conspicuous place on their electric meter or meter box to notify the MSC personnel that there is a generator source installed on the load side of the meter. The warning label shall not be placed in a location that would interfere with the ability of MSC personnel to read the electric meter. The MSC will provide the warning label to the Generator Owner. The warning label must be placed *before* the generation can be interconnected.
- XI Disconnection and Reconnection.** The MSC may disconnect a distributed generation unit under the following conditions:
- 1. Application Termination** - Upon termination of the approved Interconnection Application.
  - 2. Non Compliance** - For non-compliance with the technical guidelines specified in this document or other requirements contained in the applicable Customer Tariff, provided that the MSC has given notice to the Generator Owner and provided the Generator Owner reasonable time (consistent with the condition) to correct such non-compliance. The MSC will reconnect the unit only upon receipt of certification from the Generator Owner and verification by the MSC that the unit is in compliance. The MSC will provide verification within a reasonable time period.
  - 3. In Case of a System Emergency Outage of the MSC's Primary Electrical Sources** - The Generator Owner's generation equipment must be installed and configured so that parallel operation must automatically cease immediately and automatically during outages or loss of the MSC's electric source in accordance with these guidelines. The Generation Owner must also cease parallel operation upon notification by the MSC of a system emergency, abnormal condition or in cases where such operation is determined to be unsafe, interferes with the supply of service to other customers or interferes with the MSC's system maintenance or operation. In addition, the MSC may disconnect the generator from the system for system emergencies without notice. However, the MSC will use reasonable efforts to notify the Generation Owner prior to disconnecting.
  - 4. For Routine Maintenance and Repairs** - The MSC may disconnect a Customer/Generation Owner for routine maintenance and repairs on the MSC's system consistent with applicable tariffs and agreements. The MSC will make reasonable *efforts* to provide advance notice to the Customer/Generation Owner of service interruptions resulting from routine maintenance. The MSC will reconnect the Customer/Generation Owner as quickly as possible under reasonable operations constraints following any such service interruption.
- XII Termination** - The Generation Owner may terminate the approved Interconnection Application at any time upon thirty (30) days of providing written notice to the MSC. The MSC may terminate the Interconnection Application for cause after 60 days written notice to the Generator Owner of a material violation of the terms of the approved Interconnection Application and after the Generator Owner has had a reasonable opportunity to remedy the violation. The Generator Owner must give the MSC notice that it intends to permanently shut down his generation.

**XIII Privileged Communications Concerning Proposed Distributed Generation Projects** - In the course of processing applications for parallel operation and in the conduct of pre-interconnection studies, the Generator Owner shall provide the MSC with detailed information concerning the proposed distributed generation project. The MSC shall not use such knowledge of proposed distributed generator projects submitted to it for review to prepare competing proposals to the Generator Owner whereby the MSC, or its affiliate, offers either discounted rates in return for not installing the distributed generation, or offers competing distributed generation projects.

**XIV Technical Guidelines for Parallel Operation of On-site Distributed Generation Units** - This subsection describes minimum requirements and procedures for *safe* and effective connection and operation of distributed generation. A Generator Owner may operate 60 Hertz, three phase or single phase generating equipment, whether a qf or non-qf, in parallel with the MSC's system pursuant to an approved Interconnection Application provided that the equipment and Generator Owner meet or exceed the requirements of these guidelines or the NEM Rider Tariff requirements and that the MSC has approved the Generator Owner's application to interconnect. This subsection describes typical interconnection requirements. Certain specific interconnection locations and conditions may require the installation of additional protective hardware or special protection settings, especially when exporting power to the system. If the MSC concludes an application for parallel operation requires additional protective hardware or special protection settings, the MSC shall make those requirements known to the Generator Owner after all pertinent studies are completed. Approval to connect to the MSC system indicates only that the minimum requirements for a *safe* proper interconnection have been satisfied. Such approval does not imply that the Generator Owner's facility meets all City of New Castle land use, zoning or planning approvals.

**A. General Interconnection and Protection Requirements.**

- 1) The Generator Owner's generation and interconnection installation must meet all applicable City of New Castle land use, zoning, and planning approvals in addition to national, state, and local construction and safety codes.
- 2) The Generator Owner's generator shall be equipped with protective hardware and software designed to prevent the generator from energizing one of the MSC's de-energized circuits. The Generator Owner's generator must automatically disconnect from the MSC's system if the Grid source is lost, irrespective of connected loads or other generators.
- 3) The generator shall be equipped with the necessary protective hardware and software designed to prevent sustained parallel operation of the generating equipment with the MSC's system unless the system service voltage and frequency are within acceptable magnitudes.
- 4) Pre-approved equipment shall be accepted as part of an interconnection proposal without the need to re-review the equipment itself. However, the application, design and setting of pre-approved units and/or equipment must be reviewed and coordinated according to the unique needs of the specific location of the proposed installation.

- 5) The Generator Owner will be responsible for protecting its own generating and interconnection equipment in such a manner so that MSC system outages, short circuits, single phasing conditions or other disturbances including zero sequence currents and ferroresonant over-voltages do not damage the Generator Owner's generating equipment. The protective equipment shall also prevent excessive or unnecessary tripping that would adversely affect the MSC's service reliability to other Generator Owners and Customers.
- 6) The generator and interface protection schemes shall be continuously monitored and functioning and the generator shall immediately disconnect from the MSC's system for any condition that would make the protection scheme inoperable.
- 7) The operating power required for the protection and control schemes for the generator and the control power used to disconnect the generator from the MSC must not be dependent on local MSC grid power.
- 8) Where multiple generators are connected to the system through a single point of common coupling, the sum of the ratings of the generators will be used to determine the applicability of these guidelines. Protection scheme performance with one or more units *off* line will have to be considered.
- 9) Applicable circuit breakers or other interrupting devices at the Generator Owner's facility must be capable of interrupting the maximum available fault current at the site, including any contribution from the Owner's generator(s).
- 10) The Generator Owner will furnish and install a manual disconnect device which, when opened, will have the effect of isolating the generator from the MSC's system. The disconnect device shall have a visible break (a disconnect switch, a draw-out circuit breaker, fuse block, etc. as appropriate to the voltage level), will at all times be accessible to the MSC's personnel, and shall be capable of being locked in the open position via a MSC padlock. The MSC shall use reasonable efforts to utilize padlocks of a size consistent with typical manufacture's specifications. The Generator Owner shall follow the MSC's switching, clearance and tagging procedures.
- 11) The design, procurement, installation, and maintenance of the equipment at the Generator Owner's site are the responsibility of the Generator Owner and at the Generator Owner's expense.
- 12) Any necessary enhancements or improvements needed within the MSC's system and/or at the Customer site(s) to accommodate the parallel interconnection of the Generator Owner's generation will be at the Generator Owner's expense.
- 13) The Generator Owner has full responsibility and liability for the safe and proper operation of their equipment and the power originating from their generator. The Generator Owner is also responsible for synchronizing their generator(s) with the MSC's system and maintaining synchronous operation.

- 14) The Generator Owner must immediately cease parallel operation upon notification by the MSC if such operation is determined to be unsafe, interferes with the supply of service to other customers, or interferes with the MSC's system maintenance or operation.
- 15) The MSC reserves the right to specify the type of transformer connection (e.g. delta-delta, wye-delta, wye-wye) that will be employed for all multiphase interface transformers consistent, where reasonable, with the Generator Owner's power system.

**B. Prevention of Generator Owner Generation Interference with MSC Systems.** To eliminate undesirable interference caused by operation of the Generator Owner's generating equipment, the Generator Owner's generator shall meet the following criteria:

- 1) **Voltage** - The generating equipment will be operated in such a manner that the voltage levels on the MSC's system are in the same range as if the generating equipment were not connected to the MSC's system. The Generator Owner shall provide an automatic method of initiating a disconnect sequence of his generating equipment from the MSC system with set points noted in the table below.

<b>Generating Systems with Inverters Greater than 25kw</b>	<b>Non-Inverter or Rotating Machine Generating Systems</b>
<ul style="list-style-type: none"> <li>• Trip in 0.1 Second for <math>V &lt; 50\%</math></li> <li>• Trip within 0.1 to 30 seconds for <math>50\% \leq V &lt; 88\%</math></li> <li>• Trip within 0.1 to 30 seconds for <math>106\% &lt; V &lt; 137\%</math></li> <li>• Trip in 0.03 second for <math>137\% \leq V</math></li> </ul> <p>(Specific voltage and time delay set points will be determined for each installation.)</p>	<ul style="list-style-type: none"> <li>• Trip in 0.1 second for <math>V \geq 115\%</math></li> <li>• Trip within 0.1 to 30 seconds for <math>V &gt; 110\%</math> or <math>V &lt; 90\%</math></li> </ul> <p>(Specific voltage and time delay set points will be determined for each installation.)</p>

Note: Trip time refers to the time between when the abnormal voltage condition occurs and the generator being completely disconnected from the MSC system .

On three phase generator installations, full three phase voltage sensing should be employed. Voltages must be sensed on the high side of any interface transformer if the transformer high voltage winding is ungrounded.

The Generator Owner may reconnect to the grid when the system voltage returns to normal range and is stabilized as defined in Section III, Definitions.

- 2) **Flicker** - The Generator Owner shall not cause excessive voltage flicker on the MSC's system. This flicker shall not exceed the "Borderline of Irritation" curve, Fig. 10.3, as define in IEEE Std 519-1992, *Recommended Practices and Requirements for Harmonic Control in Electric Power Systems*. Lower levels of flicker may be required in areas where equipment such as computers and instrumentation are impacted.
- 3) **Frequency** - The operating frequency of the generating equipment shall not deviate more than the values noted in the table below.

<b>Generating Systems with Inverters Greater than 25kw</b>	<b>Non-Inverter or Rotating Machine Generating Systems</b>
<ul style="list-style-type: none"> <li>• Trip in 0.1 second for <math>F &lt; 59.3</math> Hz</li> <li>• Trip in 0.1 second for <math>F &gt; 60.5</math> Hz.</li> </ul> (Other frequency and time delay set points may be necessary for a specific installation.)	<ul style="list-style-type: none"> <li>• Trip in 0.1 second for <math>F &lt; 59.3</math> Hz</li> <li>• Trip in 0.1 second for <math>F &gt; 60.5</math> Hz.</li> </ul> (Other frequency and time delay set points may be necessary for a specific installation.)

**Note:** Trip time refers to the time between when the abnormal frequency condition occurs and the generator being completely disconnected from the MSC system.

The Generator Owner may reconnect when the system frequency returns to normal range and is stabilized as defined in Section III, Definitions

- 4) **Harmonics** - Non-linear circuit elements such as an inverter can produce harmonics. Per IEEE std 519. *Recommended Practices and Requirements for Harmonic Control in Electric Power Systems*, Table 11.1, the total harmonic distortion (THD) voltage shall not exceed 5% of the fundamental 60 Hz frequency nor 3% of the fundamental for any individual harmonic as measured at the location where the customer interfaces with the MSC's system (Point of Common Coupling). In addition, the level of harmonic current that the customer is allowed to inject into the MSC's system shall not exceed that specified in Table 10.3 in IEEE Std 519. Furthermore, any communication notch should be limited as defined by Table 10.2 in IEEE Std 519. The preceding requirements apply to all types of generation systems. The Generator Owner is responsible for the installation of



any necessary controls or hardware to limit the voltage and current harmonics generated by his equipment to defined levels.

- 5) **Power Factor** - The generator must not adversely impact the power factor of the Generator Owner site. Most inverters are designed to operate close to unity power factor. The operating power factor of the generator shall be contained within the limits defined in the table below.

<b>Generating Systems with Inverters Greater than 25kW</b>	<b>Non-Inverter or Rotating Machine Generating Systems</b>
0.985 Lagging or Leading When output exceeds 10% of inverter rating.	0.985 Lagging or Leading

However, to the extent that a Generator Owner's power factor at the Point of Common Coupling falls below 0.95 lagging as a direct result of the installation of the generating unit(s), the Generator Owner must obtain, install and maintain, at his expense, corrective apparatus that compensates for the drop in power factor caused by the installation of the generator. Penalties may be assessed for power factors that fall below 0.985 lagging or leading.

- 6) **Current** - In some cases, directional over-current protection may be required to limit fault current flowing onto the Grid in the event of a line fault. DC inverters that are incapable of producing fault current do not require directional over-current protection.

Inverter systems should not inject DC current greater than 0.5% of rated inverter output into the AC interface point under either normal or abnormal conditions.

- 7) **Fault and Line Clearing** - The Generator Owner shall automatically disconnect from the MSC's system during electrical faults on the MSC's electrical system and upon loss of the MSC's electric source. The Generator Owner may reconnect when the system voltage and frequency return to normal range and is stabilized as defined in Section III, Definitions. Detection of the loss of the MSC's primary electric system, where the Generator Owner is operating in an island with other customer load, becomes increasingly difficult as the level of distributed generation on a feeder approaches the connected load.

- 8) **Automatic Reclosing** - The Generator Owner is responsible for protecting his equipment from the effects of switching or automatic reclosing of the MSC's feeder circuit.

**C. Control, Protection and Safety Equipment Requirements Specific to Generators of 50 kW or Less.**

All Generator Owners 10 kW or less can be single phase. Customer owned generators greater than 10 kW must be evaluated by the MSC to determine if it can be single phase. The following table describes necessary control, protection and safety equipment specific to generator of 50 kW or less connected to Secondary or Primary Voltage Systems:

**Control, Protection and Safety Equipment for Generators of  
500kW or Less Connected to  
Secondary or Primary System**

Generator Size 50 kW or Less

Over-Current Trip	X
Over-Voltage Trip	X
Under-Voltage Trip	X
Over/Under Frequency Trip	X
 Synchronizing Check <sup>2</sup>	 Manual or Automatic

Notes:

1. Exporting to the MSC's system may require additional operational/protection devices
2. For synchronous and other type of generators with stand alone capability

**D) Control, Protection and Safety Requirement Specific to Three Phase Synchronous Generators, Induction Generators, and Inverter Systems.**

Generators greater than 50 kW must be three phase machines connected to three phase circuits.

- 1) **Three Phase Synchronous Generators.** Generator circuit breakers shall be three phase devices with electronic or electromechanical control. The Generation Owner is solely responsible for properly synchronizing his generator with the MSC's system. For a synchronous generator, the excitation system response ratio shall not be less than 0.5 (five-tenths). The generator's excitation system(s) shall conform, as closely as reasonably achievable, to the field voltage vs. time criteria specified in American National Standards Institute Standard C50.13-19899 in order to permit adequate field *forcing* during transient conditions.
- 2) **Three Phase Induction Generators and Inverter Systems.** Induction generation may be connected and brought up to synchronous speed (as an induction motor) if it can be demonstrated that the initial voltage drop measured on the MSC's side at the point of common coupling is within the visible flicker limits established by the MSC. Otherwise, the Generator Owner may be required to install hardware or use other techniques to bring voltage fluctuations to acceptable levels. Line-commutated inverters do not require synchronizing equipment. Self-commutated inverters whether of the utility-interactive type or stand-alone type shall be used in parallel with the MSC system only with synchronizing equipment.

**Control, Protection and Safety Equipment  
Greater than 25 kW and Less than 500KW,  
Three phase Connected to Primary System**

Generator Disconnect Device	X
Over-Voltage Trip	X
Under-Voltage Trip	X
Over -Current Trip	X
Over/Under-Current Trip	X
Ground Over-Voltage Trip <sup>2</sup> or Ground Over-Current Trip <sup>2</sup>	X
Synchronizing Check <sup>3</sup>	Manual or Automatic
Power Direction <sup>4</sup>	X
Transfer Trip/Reclose Blocking <sup>5</sup>	X

Notes:

1. Exporting to the MSC system may require additional operating/protection devices and will require coordination of operations with the MSC
2. Selection depends on grounding system, if required by MSC
3. For synchronous and other types of generators with stand-alone capability
4. Required only if generator size is greater than Generator Owner's minimum load and thus capable of exporting. The relay will operate if the power flow from the generator into the Grid exceeds a predetermined level. A time delay will have to be incorporated into this relaying scheme to prevent it from operating during synchronous swings.
5. May be required as part of any necessary transfer tripping/reclose blocking protection scheme.

**E) Requirements Specific to Generators paralleling for 0.1 second or less (Closed Transition Switching)**

The table below shows the protective functions required by this requirement for generators less than 500 kW which parallel with the MSC system for 0.1 second or less such as during source or load transfer.

**Control, Protection and Safety Equipment  
Generators Connected to Secondary or Primary System Voltage  
For 0.1 Second or Less  
(Closed Transition Switching)  
Generator Size up to 500 kW**

Over-Voltage Trip	X
Under-Voltage Trip	X
Synchronizing Check <sup>1</sup>	Manual or Automatic
Excessive Closed Time Trip <sup>2</sup>	X

Notes:

1. For synchronous and other types of generators with stand-alone capability
2. Scheme will trip generator if closed transition parallel mode remains in effect longer than

0.1 second.

- F. **Inverter Type** - DC Generation installations using inverters for interconnection with the MSC must use non-islanding type inverters as defined in IEEE 929, *IEEE Recommended Practices for Utility Interface of Photovoltaic (PV) Systems* (including Annex B, D, E & G) and UL Subject 1741, May 1999, *Standard for Static Inverters and Charge Controllers for use in Photovoltaic Power Systems*.
- G. **Inspection and Start-Up Testing** - the Generator Owner shall provide the MSC with reasonable prior notice at least 2 weeks before the initial energizing and start-up testing of the Generator Owner's generating equipment and the MSC, at its discretion, shall witness the testing of any equipment and protective systems associated with the interconnection. The Generator Owner shall revise and re-submit the application information for any proposed modification that may affect the safe and reliable operation of the MSC's system. The generator may be reconnected to the MSC system only after the modified application has been reviewed, testing has been confirmed and the MSC has given approval to reconnect.
- H. **Site Testing and Commissioning** - Testing of protection systems shall include procedures to functionally test all protective elements of the installation up to and including tripping of the generator and interconnection point. Testing and testing intervals should be in accordance with manufacturers' and industry recommendations. Testing will verify all protective set points and relay/breaker trip timing. The MSC may witness the testing of installed switchgear, protection systems, and generator. The Generator Owner is responsible for all maintenance of the generator, control and protective equipment. The Generator Owner will maintain records of such maintenance activities which the MSC may review at reasonable times.
- I. **Metering** - Metering requirements will be reviewed on each specific installation.
- J. **Dedicated Transformer** - A dedicated transformer will be required where the generating Generator Owner is served from the same transformer secondary as another MSC customer and inverter-based technology not meeting IEEE 929/1999 and IEEE 519-1992 specifications is used. In addition, a dedicated transformer or other current-limiting device is needed for any type of generator installation where the increase in available short circuit current could adversely impact other MSC customers on the same secondary circuit.
- K. **Suggested References** The following references can supply technical support and insight into the safe, reliable interconnection of distributed generation with the MSC's systems. These references should be reviewed by those individuals or firms contemplating parallel operation of generation with the MSC.

IEEE C37.95-1989 - *IEEE Guide for Protective Relaying of Utility-Consumer Interconnections*

IEEE Std 1001 (1988) - *IEEE Guide for Interfacing Dispersed Storage and Generation Facilities with Electric Utility Systems*

- *IEEE Recommended Practices for Utility Interface of Photovoltaic (PV) Systems*

IEEE Std 1021 (1988) - *IEEE Recommended Practices for Utility Interconnection of Small*