Attachment A

Table 1- Requirements Common to Applications up to 15 kW

Power Factor Correction	The power factor should be > 0.85 at 10% of rated output and at least 0.95 at full rated output.
Harmonic Injection, Voltage Quality and Flicker	The distributed generation unit should not create voltage flicker in excess of the "border-line of irritation" specified in Institute of Electrical and Electronic Engineers (IEEE) Standard 519-1992 Figure 10.3. Harmonic distortion contributions should be within the IEEE 519-1992 Table 10.3 specified limits. Steady state voltage will be maintained within American National Standards Institute (ANSI) C84.1-1995 limits. Speed matching of induction generators (within 1%), proper synchronization/voltage matching of synchronous generators (within 10 electrical degrees and a few percent voltage magnitude) and soft-start of inverters are means to help reduce voltage flicker impacts on distribution circuits at the moment of interconnection – these practices should be employed where necessary to reduce flicker impacts.
Distributed Generation (DG) System Disconnect Switch	A utility accessible, lockable, load break rated, visible break disconnect switch with safe working clearances is required for all installations. One exception is that a lockable disconnect plug unit is acceptable for small DG units less than 500 watts if the customer files a proper application with the utility (the utility company will define the means by which the plug may be locked). The disconnect plug must be able to break load and be in a utility accessible location.
High Side Fault Protection	A fuse is suitable but it should be capable of handling the fault current contribution of the DG unit without melting.
Low Side Fault Protection	A UL-listed fuse or molded case circuit breaker of suitable current and voltage rating is acceptable. The DG unit may be connected to the existing customer service panel via a dedicated circuit breaker or fuse in that panel in accordance with national electrical code requirements.
Underwriters Laboratories (UL) and National Electric Code (NEC) requirements	Inverters should be UL listed and installations shall be in conformance with applicable NEC requirements.
	The existing site transformer serving the customer load may be used if its use will not seriously degrade the power quality or voltage regulation on the secondary distribution system and if such usage will not create problems for utility system

Step-up transformer Configuration	relaying. For single phase distributed generators connected to four wire multi-grounded neutral systems, the high side of the step-up transformer should be connected phase to neutral. A phase to phase high side connection is only allowed pending approval of the local utility. For single phase distributed generators connected to three wire or four wire impedance grounded systems, the step-up transformer high-side winding should be connected phase to phase. For three phase distributed generators connected to four wire multi-grounded distribution systems, the step-up transformer may be an existing grounded-wye to grounded-wye transformer. In such cases the generator may need to be impedance grounded as is necessary to achieve effective grounding but limit the desensitization of the utility system ground fault relaying. If an ungrounded transformer configuration is used, then appropriate ground fault overvoltage detection using a 59G relay function on the utility primary must be provided to help prevent overvoltages on the utility primary.
Periodic Testing	Units will be tested initially upon installation and once every two years to determine that the anti-islanding controls are still functioning. For units less than 15 kW the disconnect switch is operated and the unit must shutdown within the normal feeder reclosure dead time or 2 seconds – whichever is shorter.
Studies and Analysis	Detailed load flow, voltage regulation, or short circuit coordination studies of the primary feeder are not required unless the addition of a DG unit pushes the aggregate capacity of DG on the feeder to the threshold level where a new study is required. The threshold of concern for aggregate DG is typically the lower of 10% of the peak feeder demand as measured at the substation or 20% of the peak feeder demand downstream of the point of interconnection. Special analysis of the generator's impact on the distribution secondary may be required in cases where more than one DG unit is installed on the same secondary shared by many

	customers.

Table 2 – Specific Interconnection requirements for net metering classified generators up to 15 kW using inverters (static power converters)

Description of DG Element	**Minimum Requirement**
Anti-islanding Functions	**The units are not allowed to island with a portion of the utility system.** To prevent islanding of the distributed generator, the inverter will include undervoltage, overvoltage, underfrequency and overfrequency protection consistent with IEEE P929 Draft 9 recommendations which will disable operation of the unit when outages or out of range voltage or frequency conditions occur on the utility system. Inverters should also include an active anti-islanding method as discussed in IEEE P929 Draft 9.
List of Protective Functions Required and Grade of relay	Inverter protective functions will include: *Undervoltage /Overvoltage (27, 59)* *Under frequency/Overfrequency (81/U, 81/O)* *Overcurrent (50,51,51G)* *Synchronization (25)* *Ground Fault Overvoltage (59G) – for non-effectively grounded systems* *Active-Anti Island Function* Imbedded electronic controls, or microprocessor-based algorithms included within the inverter are suitable in lieu of utility grade relays for the above functions as long as they satisfy IEEE P929 Draft 9 and UL1741 requirements.
Reconnect/Auto-restart Function Using a Resetting or Interrupting Device	Not required but recommended (IEEE P929 Draft 9 recommends a 5-minute waiting period after return of normal utility voltage). The interrupting device used for this function may be a contactor or solid state device.

Table 3 – Specific Interconnection requirements for net metering classified generators up to 15 kW using rotating power converters (induction generators or synchronous generators)

Description of DG Element	Minimum Requirement
Anti-islanding Functions	**The units are not allowed to island with a portion of the utility system**. To prevent islanding of the distributed generator rotating power converter will include undervoltage, overvoltage, underfrequency and overfrequency protection set to limits which will disable the operation of the machine (disconnect it from the utility system) when outages or out of range voltage or frequency conditions occur on the utility system.
List of Protective Functions Required and Grade of relay	Rotating machine protective functions will include: *Undervoltage/overvoltage (27, 59)* *Under frequency/Overfrequency (81/U, 81/O)* *Overcurrent (50,51,51G)* *Synchronization (25) – for synchronous generators only* *Speed matching (15) – for induction generators only* *Ground fault overvoltage (59G) – for non-effectively grounded systems* Industrial relays, imbedded electronic controls, or microprocessor-based algorithms are suitable in lieu of utility grade relays for the above functions as long as they provide sufficient accuracy and reliability to prevent islanding of the generator and to maintain service voltage conditions within ANSI C84.1-1995 limits.
Reconnect/Auto-restart Function Using a Resetting or Interrupting Device	Not required but recommended (IEEE P929 Draft 9 recommends a 5-minute waiting period after return of normal utility voltage). The interrupting device used for this function should be a contactor or other mechanical interrupting device.