I. FOREWARD

Electric Distribution system connected generation units span a wide range of sizes and electrical characteristics. Electrical distribution system design varies widely from that required to serve the rural customer to that needed to serve the large commercial customer. With so many variations possible, it becomes complex and difficult to create an interconnection standard that fits all generation interconnection situations.

In establishing a generation interconnection standard there are three main issues that must be addressed: Safety, Economics and Reliability.

The first and most important issue is safety – the safety of the general public and of the employees working on the electrical systems. This standard establishes the technical requirements that must be met to ensure the safety of the general public and Clearwater-Polk Electric Cooperative (CPEC) employees and its system. Typically, designing the interconnection system for the safety of the general public will also provide protection for the interconnected equipment.

The second issue is economics – the interconnection design must be affordable to build.
interconnection standard must be developed so that only those items that are necessary to meet safety and reliability are included in the requirements. This standard sets the benchmark for the minimum required equipment. If it is not needed, it will not be required.

The third issue is reliability – the generation system must be designed and interconnected such that the reliability and the service quality for all members of CPEC is not compromised.

Many generation interconnection standards exist or are in draft form. The Institute of Electrical and Electronics Engineers (IEEE), Federal Energy Regulatory Commission (FERC) and many states have been working on generation interconnection standards. There are other standards such as the National Electric Code (NEC) that establish requirements for electrical installations. The above requirements are in addition to this standard. This standard is designed to document the requirements where the others have left the establishment of the standards to “the authority having jurisdiction” or to cover issues which are not covered in other national standards. This standard covers installations with an aggregated capacity up to 10MW.

II. INTRODUCTION

This standard has been developed to document the technical requirements for the interconnection between a Generation System and CPEC’s system. This standard covers Generation Systems with an aggregate capacity of 10 MW or less at the Point Of Common Coupling. This standard covers Generation Systems that are interconnected with CPEC’s system.

CPEC has the right to limit the maximum size of any Generation System or number of Generation Systems that may want to interconnect if the Generation System would reduce the reliability to the other members connected to CPEC’s system.

This standard only covers the technical requirements and does not cover the interconnection process from the planning of a project through approval and construction. Please read the companion document “Clearwater-Polk Electric Cooperative’s Interconnection Process for Generation Systems” for the description of the procedure to follow and a generic version of the forms to submit. It is important to also get copies of CPEC’s rate schedules which will include available rates and applicable costs. The earlier the member or their consultant gets CPEC involved in the planning and design of the Generation System interconnection, the smoother the process will go.

III. DEFINITIONS

The definitions defined in the “IEEE Standard for Interconnecting Distributed Resources with Electric Power Systems” (1547) apply to this document as well. The following definitions are in addition to the
ones defined in IEEE 1547, or are repeated from the IEEE 1547 standard.

A. **Area EPS**: an electric power system (EPS) that serves Local EPSs. Note: Typically, an Area EPS has primary access to public rights-of-way, priority crossing of property boundaries, etc.

B. **Area EPS Operator**: the entity that operates the Area EPS.

C. **Closed Transition Transfer**: Method of transferring the local loads between Clearwater-Polk’s system and the generator of such that the generator and CPEC’s system are interconnected for a short time (100 msec. or less).

D. **Dedicated Facilities**: the equipment that is installed due to the interconnection of the Generation System and not required to serve other Area EPS members.

E. **EPS**: (Electric Power System) facilities that deliver electric power to a load. Note: This may include generation units.

F. **Extended Parallel**: The Generation System is designed to remain connected with Clearwater-Polk for an extended period of time.

G. **Generation**: any device producing electrical energy, i.e., rotating generators driven by wind, steam turbines, internal combustion engines, hydraulic turbines, solar, fuel cells, etc., or any other electric producing device, including energy storage technologies.

H. **Generation Interconnection Coordinator**: the person or persons designated by Clearwater-Polk to provide a single point of coordination with the Applicant for the generation Interconnection process.

I. **Generation System**: the interconnected generator(s), controls, relays, switches, breakers, transformers, inverters and associated wiring and cables, up to the Point of Common Coupling.

J. **Interconnection Member**: the party or parties who will own/operate the Generation System and are responsible for meeting the requirements of the agreements and Technical Requirements. This could be the Generation System applicant, installer, owner, designer, or operator, or any combination of these entities.

K. **Local EPS**: an electric power system (EPS) contained entirely within a single premises or group of premises.
L. **Nameplate Capacity:** the total nameplate capacity rating of all the Generation included in the Generation System. For this definition the “standby” and/or maximum rated KW capacity on the nameplate shall be used.

M. **Open Transition Transfer:** Method of transferring the local loads between Clearwater-Polk’s system and the generator such that the generator and CPEC’s system are never Interconnected.

N. **Point of Common Coupling:** the point where the Local EPS is connected to an Area EPS

O. **Point of Delivery:** the point where the energy changes possession from one party to the other. Typically this will be where the metering is installed but it is not required that the Point of Delivery is the same as where the energy is metered.

P. **Soft Loading Transfer:** Method of transferring the local loads between Clearwater-Polk’s system and the generator such that the generator and CPEC’s system are interconnected for a limited amount of time (generally less than three minutes). If the interconnection extends beyond three minutes, the interconnection is then defined as extended parallel.

Q. **Technical Requirements:** Clearwater-Polk Electric Cooperative, Inc. “Interconnection Requirements for Generation Systems”.

### IV. INTERCONNECTION REQUIREMENTS GOAL

This standard defines the minimum technical requirements for the implementation of the electrical interconnection between the Generation System and CPEC. It does not define the overall requirements for the Generation System. The requirements in this standard are intended to achieve the following:

A. Ensure the safety of utility personnel and contractor working on the electrical power system.
B. Ensure the safety of utility members and the general public.
C. Protect and minimize the possible damage to the electrical power system and other members’ property.
D. Ensure proper operation to minimize adverse operating conditions on CPEC’s electrical power system.

### V. PROTECTION

The Generation System and Point of Common Coupling shall be designed with proper protective devices to promptly and automatically disconnect the Generation from CPEC’s system in the event of a fault or
other system abnormality. The type of protection required will be determined by:

A. Size and type of the generating equipment.
B. The method of connecting and disconnecting the Generation System from CPE’s electrical power system.
C. The location of generating equipment on CPE’s system.

VI. CPEC System Modifications

Depending upon the match between the Generation System, CPE’s system, and how the Generation System is operated, certain modifications and/or additions may be required to CPE’s existing system with the addition of the Generation System. To the extent possible, this standard describes the modifications which could be necessary to CPE’s system for different types of Generation Systems. For some unique interconnections, additional and/or different protective devices, system modifications and/or additions will be required by CPE. In these cases, CPE will provide the final determination of the required modifications and/or additions. If any special requirements are necessary they will be identified by CPE during the application review process.

VII. Generation System Protection

The Interconnection Member is solely responsible for providing protection for the Generation System. Protection systems required in this standard are structured to protect CPE’s system and the public. The Generation System protection is not provided for in this standard. Additional protection equipment may be required to ensure proper operation for the Generation System. This is especially true while operating disconnected from CPE’s system. CPE does not assume any responsibility or liability for protection of the Generation System equipment or of any portion Local EPS.

VIII. Electrical Code Compliance

The Interconnection Member is solely responsible for complying with all applicable local, independent, state and federal codes such as, but not limited to: building codes, National Electric Code (NEC), National Electric Safety Code (NESC) and noise and emissions standards. As required by Minnesota law, CPE will require proof of complying with the National Electrical Code through installation approval by an electrical inspector recognized by the Minnesota State Electrical Board before the interconnection is made.

The Interconnection Member’s Generation System and installation shall comply with the latest revisions of the ANSI/IEEE standards applicable to the installation, especially IEEE 1547 “Standard for Interconnecting Distributed Resources with Electric Power Systems”. See the reference section in this
document for a list of the standard which apply to the generation installations covered by this standard.

IX. References

The following standard shall be used in conjunction with this standard. When the stated version of the following standards is superseded by an approved revision then that revision shall apply.

IEEE Std 100-2000, “IEEE Standard Dictionary of Electrical and Electronic Terms”


IEEE Std C62.41.2-2002 “IEEE Recommended Practice on Characterization of Surges in Low Voltage (1000V and Less) AC Power Circuits”


UL Std 1741, “Inverter, Converters and Controllers for use in Independent Power Systems”

X. Types of Interconnections

The manner in which the Generation System is connected to and disconnected from CPE’s system can vary. If a transfer system is installed which has a user accessible selection of several transfer modes, the transfer mode that has the greatest protection requirements will establish the protection requirements for that transfer system. Most transfer systems normally operate using one of the following four methods of transferring the load from CPE’s system to the Generation System. Reference to loads or capacity level refer to the total load of the generator or combined generators in the case of multiple power sources. Where multiple transfer switches are used with one or more generators, the combined total of the generation capacity or load served is the value to be used when determining which type of interconnection is applicable.

A. Open Transition (Break-Before-Make) Transfer Switch – With this transfer switch, the load to be supplied from the Generation System is first disconnected from CPE’s system and then connected to the Generation. This transfer can be relatively quick, but voltage and frequency excursions are to be expected during transfer. Computer equipment and other sensitive equipment will shut down and reset. The transfer switch typically consists of a standard UL approved transfer switch with mechanical interlocks between the two source contactors that drop CPE’s system source before the Generation System is connected to supply the load.

1. To qualify as an Open Transition switch and the limited protective requirements, mechanical interlocks are required between the two source contacts. This is required to ensure that one of the contacts is always open and the Generation System is never operated in parallel with CPE’s system. If the mechanical interlock is not present, the protection requirements are as if the switch is a closed transition switch.

2. As a practical point of application, this type of transfer switch is typically used for loads less than 500KW. This is due to possible voltage flicker problems created on CPE’s system, when the load is removed from or returned to CPE’s system as a source. CPE strongly recommends the Interconnecting Member discuss all relative aspects of an open transition transfer switch operation with CPE’s Engineer to properly understand the possible detrimental effects of this transition switch operation program on the Member’s equipment.

3. CPE will allow a maximum project size of 300 KW using this type of transfer switch if the Interconnecting Member desires to participate in CPE’s load management program using the Generator as an alternate power source.
4. Figure 1 at the end of this document provides a typical one-line diagram of this type of installation.

B. Closed Transition (Make-Before-Break) Transfer Switch – The Generation System is synchronized with CPE’s system prior to the load transfer occurring. The transfer switch then parallels with CPE’s system for a short time (100 msec. or less) and then the Generation System and load is disconnected from CPE’s system. This transfer is less disruptive than the Open Transition because it allows the Generation System a brief time to pick up the load before the support of CPE’s system is lost. With this type of transfer, the load is always being supplied by CPE’s system or the Generation System.

1. As a practical point of application this type of transfer switch is typically used for loads less than 500 KW. This is due to possible voltage flicker problems created on CPE’s system, when the load is removed from or returned to CPE’s system source. Depending on CPE’s system stiffness this level may be larger or smaller than the 500 KW level.

2. CPE will allow generators up to 750 KW to utilize this type of transfer switch.

3. Figure 2 at the end of this document provides a typical one-line diagram of this type of installation and shows the required protective elements. The closed transition switch must include a separate parallel time limit relay, reverse power flow relay, and over-current relay which is not part if the generation control Programmable Logic Control (PLC). These relays trip the generation from the system for a failure of the transfer switch and/or the transfer switch controls.

C. Soft Loading Transfer Switch

1. With Limited Parallel Operation – The Generation System is paralleled with CPE’s system for a limited amount of time (generally less than 3 minutes) to gradually transfer the load from CPE’s system to the Generation System. This minimizes the voltage and frequency problems by gradually loading and unloading the Generation System.

   a. CPE requires this type of transfer switch for generators larger than 750 KW. A minimum project size of 500 KW is required to utilize this type of transfer switch.

   b. The maximum parallel operation shall be controlled via a parallel timing limit relay (62PL). This parallel time limit relay shall be a separate relay and not part of the generation control PLC.

   c. Additional protective relaying is required as described in section XIII.

   d. Figure 3 at the end of this document provides a typical one-line diagram of this type of
installation and shows the special protection coordination.

2. With Extended Parallel Operation – The Generation System is paralleled with CPE’s system in continuous operation. Special design coordination and agreements are required before any extended parallel operation will be permitted. CPE will complete an interconnection study that will identify the issue involved.


   b. Protective Relaying is required as described in section XIII.

   c. Figure 4 at the end of this document provides a typical on-line diagram for this type of interconnection. It must be emphasized that this is a typical installation only and final installations may vary from the example shown due to transformer connections, breaker configuration, etc.

D. Inverter Connection – This is a continuous parallel connection with the system. Small Generation Systems may utilize inverters to interface to CPE’s system. Solar, wind and fuel cells are some examples of Generation which typically use inverters to connect to CPE’s system. The design of such inverters shall either contain all necessary protection to prevent unintentional islanding, or the Interconnection Member shall install conventional protection to provide the same protection. All required protective elements for a soft-loading transfer switch apply to an inverter connection. Figure 5 at the end of this document shows a typical inverter interconnection.

1. Inverter Approval – The inverter shall be approved by CPE for interconnection to the electrical power system prior to installation. The approval will confirm its anti-islanding protection and power quality related levels at the Point of Common Coupling. Also, utility compatibility, electric shock hazard and fire safety are approved through UL listing of the model. Once this approval is completed for that specific model, additional design review of the inverter should not be necessary by CPE.

2. For three-phase operation, the inverter control must also be able to detect and separate for the loss of one phase. Larger inverters will still require custom protection settings, which must be calculated and designed to be compatible with CPE’s system.

3. A visible disconnect is required for safely isolating the Generation System when connecting with an inverter. The inverter shall not be used as a safety isolation device.
4. When banks of inverter systems are installed at one location, a design review by CPE must be performed to determine any additional protection systems, metering or other needs. The issues will be identified by CPE during the interconnection study process.

XI. Interconnection Issue and Technical Requirements

A. General Requirements – The following requirements apply to all interconnected generating equipment. CPE’s system shall be the source side and the member’s system shall be the load side in the following interconnection requirements.

1. Visible Disconnect – A disconnecting device shall be installed to electrically isolate CPE’s system from the Generation System. The only exception for the installation of a visible disconnect is if the generation is interconnected via a mechanically interlocked open transfer switch and installed per the NEC (702.6) “so as to prevent the inadvertent interconnection of normal and alternate sources of supply in any operation of the transfer equipment.”

   a. The visible disconnect shall provide a visible air gap between Interconnection Member’s Generation and CPE’s system in order to establish the safety isolation required for work on CPE’s system. This disconnecting device shall be readily accessible 24 hours per day by CPE’s field personnel and shall be capable of padlocking by CPE’s field personnel. The disconnecting device shall be lockable in the open position.

   b. The visible disconnect shall be a manual safety disconnect switch of adequate ampere capacity approved by either Underwriter’s Laboratories (UL) or the National Electrical Manufacturer’s Association (NEMA). The visible disconnect shall not open the neutral when the switch is open. A draw-out type circuit breaker can be used as a visual open.

   c. The visible disconnect shall be clearly labeled “Generation Disconnect” to inform CPE’s field personnel.

   d. Energization of Equipment by Generation System – The Generation System shall not energize CPE’s system if it is de-energized. The Interconnection Member shall install the necessary padlocking (lockable) devices on equipment to prevent the energization of a de-energized electrical power system. Lock out relays shall automatically block the closing of breakers or transfer switches on to a de-energized CPE system

B. Power Factor – The power factor of the Generation System and connected load shall be as follows:

   1. Inverter Based Interconnections – shall operate at a power factor of no less than +/- 90% at the
inverter terminals.

2. Limited Parallel Generation Systems, such as closed transfer or soft-loading transfer systems shall operate at a power factor of no less than +/- 90%, during the period when the Generation System is parallel with CPE’s system, as measured at the Point of Common Coupling.

3. Extended Parallel Generation Systems shall be designed to be capable of operating between 90% lagging and 95% leading. These Generation Systems shall normally operate near unity power factor (+/- 98%) or as mutually agreed between CPE and the Interconnection Member.

C. Grounding Issues


2. It is the responsibility of the Interconnection Member to provide the required grounding for the Generation System. A good standard for this is the IEEE Std. 142-1991 “Grounding of Industrial and Commercial Power Systems”.

3. All electrical equipment shall be grounded in accordance with local, state and federal electrical and Safety codes and applicable standards.

D. Energy sales to others by the Interconnecting Member – Transportation of energy on the transmission system is regulated by the reliability council and FERC. Those contractual requirements are not included in this standard. CPE will provide these additional contractual requirements during the interconnection approval process.

E. Additional Requirements – For inverter based, closed transfer and soft loading interconnections, the following additional requirements apply:

1. Fault and Line Clearing – The Generation System shall be removed from CPE’s system for any faults or outages occurring on the electrical circuit serving the Generation System.

2. The Generation System shall meet the voltage, frequency, harmonic and flicker operating criteria as defined in the IEEE 1547 standard during periods when the Generation System is operated in parallel with CPE’s system through operating limits in order to minimize objectionable and adverse operating conditions on the electric service provided to other members connected to CPE’s system.
If the Generation System creates voltage changes greater than 4% on CPE’s system, it is the responsibility of the Interconnection Member to correct these voltage sag/swell problems caused by the operation of the Generation System. If the operation of the interconnected Generation System causes flicker, which causes problems for other members connected to CPE’s system, the Interconnection Member is responsible for correcting the problem.

3. Flicker- The operation of the Generation System is not allowed to produce excessive flicker to adjacent members. See the IEE 1547 standard for a more complete discussion on this requirement.

The stiffer CPE’s system, the larger a block load change that it will be able to handle. For any of the transfer systems CPE’s system voltage shall not drop or rise greater than 4% when the load is added or removed from CPE’s system. It is important to note that if another interconnected member complains about the voltage change caused by the Generation System, even if the voltage change is below the 4% level, it is the Interconnection Member’s responsibility to correct or pay for correcting problem. Utility experience has shown that customers have seldom objected to instantaneous changes of less than 2%, so most utility operators use a 2% design criteria.

4. Interference – The Interconnection Member shall disconnect the Generation System from CPE’s system if the Generation System causes radio, television or electrical service interference to other members via the EPS or interference with the operation of CPE’s system, including possible degradation of CPE’s load management 220 Hz ripple system signal. The Interconnection Member shall either effect repairs to the Generation System or reimburse CPE for the cost of any required system modifications due to the interference.

5. Synchronization of Member Generation Systems

a. An automatic synchronizer with synch-check relaying is required for unattended automatic closed transition or soft loading transfer systems.

b. To prevent unnecessary voltage fluctuations on CPE’s system, it is required that the synchronizing equipment be capable of closing the Generation System into CPE’s system within the limits defined in IEEE 1547. Actual settings shall be determined by CPE to establish the protective settings for the installation.

c. Unintended Islanding – Under certain conditions with extended parallel operation, it would be possible for a part of CPE’s system to be disconnected from the rest of CPE’s system and have the Generation System continue to operate and provide power to a portion of the isolated circuit. This condition is called “islanding”. It is not possible to successfully reconnect the energized
isolated circuit to the rest of CPE’s system since there are no synchronizing controls associated with all of the possible locations of disconnection. Therefore, it is a requirement that the Generation System be automatically disconnected from CPE’s system to be de-energized. The Generation System must either isolate with the member’s load of trip off-line. The Generation System must also be blocked from closing back into CPE’s system until CPE’s system is Reenergized and CPE’s system voltage is within Range B of ANSI C84.1 Table 1 for a minimum of 1 minute. Depending upon the size of the Generation System it may be necessary to install direct transfer trip equipment to prevent islanding for certain conditions. The costs involved with this control modification would be the responsibility of the Interconnection Member.

d. Disconnection – CPE may refuse to connect, or may disconnect, a Generation System from CPE’s system under the following conditions:

i. Lack of approved interconnection application, interconnection agreement, or interconnection operating agreement.

ii. Termination of interconnection by mutual agreement.

iii. Non-Compliance with the technical or contractual requirements.

iv. System Emergency or for imminent danger to the public or CPE’s personnel (safety).

v. Routine maintenance, repairs, and modifications to CPE’s system. CPE shall coordinate planned outages with the Interconnection Member to the extent possible.

XII. Generation Metering, Monitoring and Control

A. CPE’s revenue meter(s) and any necessary instrument transformers for meter installations shall be Supplied, owned and maintained by CPE.

B. For Generation Systems that sell power, separate metering of the generation and of the load is required. A single meter recording the power flow at the Point of Common Coupling for both the Generation and the load, is not allowed. Meters shall have detents installed to prevent reverse rotation of the meter.

C. SCADA (Supervisory Control and Data Acquisition) options are possible through CPE’s system operation, including remote and tele-metering. Members interested in this option should contact CPE for more information and details.
XIII. Protective Devices and Systems

Protective devices required to permit safe and proper operation of CPE’s system while interconnected with Member’s Generation Systems are listed in Table 1 and shown in the figures at the end of this document. In general, an increased degree of protection is required for increased Generation System size. This is due to the greater magnitude of short circuit currents and the potential to system stability from these installations. Large installations require more sensitive and faster protection to minimize damage and ensure safety.

If a transfer system is installed which has a user accessibly selection of several transfer modes, the transfer mode which has the greatest protection requirements will establish the protection requirements for that transfer system.

The Interconnection Member shall provide protective devices and systems to detect the voltage, frequency, harmonic and flicker levels as defined in the IEEE 1547 standard during periods when the Generation System is operated in parallel with CPE’s system. The Interconnection Member shall be responsible for the purchase, installation, and maintenance of these devices. Discussion on the requirements for these protective devices and systems follows:

A. Relay settings and Testing (Trip Checks)

1. For all closed transition, soft loading, and extended parallel transition installations, CPE requires that all relay settings be made per CPE’s direction and tested by an approved entity after the installation is completed. If the Interconnection Member does not have access to an approved testing entity, CPE can arrange for the testing procedure. The Interconnection Member shall be responsible for all relay testing costs.

2. All closed transition transfer installations shall be inspected by CPE every five years from the initial date of installation. All soft loading transfer installations shall be inspected by CPE every three years from the initial date of installation. The inspection process shall include an on-site review of the installation, review of any maintenance work performed on the installation, and testing of all relays. The Interconnection Member shall be responsible for all relay testing costs. (See Commission Testing for more information)

B. Relays

1. All equipment providing relaying functions shall be utility grade and meet or exceed ANSI/IEEE
Standards for protective relays, i.e., C37.90, C37.90.1 and C37.90.2.

2. Required relays that are not “draw-out” cased relays shall have test plugs or test switches installed to permit field testing and maintenance of the relay without unwiring or disassembling the equipment. Inverter based protection is excluded from this requirement for Generation Systems less than 40KW at the Point of Common Coupling.

3. Three phase interconnection shall utilize three phase power relays, which monitor all three phases of voltage and current, unless so noted in the appendix one-line diagrams.

4. All relays shall be equipped with setting limit ranges at least as wide as specified in IEEE 1547, and Meet other requirements as specified in CPE’s system interconnect study of the Generation System installation. Setting limit ranges are not to be confused with the actual relay settings required for the proper operation of the installation. At a minimum, all protective systems shall meet the requirements established in IEEE 1547.

   a. Over-current relays (IEEE Device 50/51 or 50/51V) shall operate to trip the protecting breaker at a level to ensure protection of the equipment and at a speed to allow proper coordination with other protective devices. For example, the over-current relay monitoring the interconnection breaker shall operate fast enough for a fault on the member’s equipment, so that no protective devices will operate on CPE’s system. 51V is a voltage restrained or controlled over-current relay and may be required to provide proper coordination with CPE’s system.

   b. Over-voltage relays (IEEE Device 59) shall operate to trip the Generation System per the requirements of IEEE 1547.

   c. Under-voltage relays (IEEE Device 27) shall operate to trip the Generation System off-line per the requirements of IEEE 1547.

   d. Over-frequency relay (IEEE Device 81U) shall operate to trip the Generation System off-line per the requirements of IEEE 1547.

   e. Under-frequency relay (IEEE Device 81U) shall operate to trip the Generation System off-line per the requirements of IEEE 1547. For Generation Systems with an aggregate capacity greater than 30KW, the Distribution Generation shall trip off-line when the frequency drops below 57.0-59.8 Hz. Typically this is set at 59.5 Hz, with a trip time of 0.16 seconds, but coordination with CPE’s system is required for this setting. CPE’s system will provide the reference frequency of 60 Hz. The Generation System control system must be used to match this reference. The protective
relaying in the interconnection system will be expected to maintain the frequency of the output of the Generation.

f. Reverse power relays (IEEE Device 32) (power flowing from the Generation System to CPE’s system) shall operate to trip the Generation System off-line for a power flow to the system with a maximum time delay of 1.0 seconds.

g. Lockout Relay (IEEE Device 86) is a mechanically locking device which is wired into the close circuit of a breaker or switch and when tripped will prevent any close signal from closing that device. This relay requires that a person manually resets the lockout relay before that device can be reclosed. These relays are used to ensure that a de-energized system is not reenergized by automatic control action, and prevents a failed control from auto-reclosing an open breaker or switch.

h. Transfer Trip – All Generation Systems are required to disconnect from CPE’s system when CPE’s system is disconnected from its source to avoid unintentional islanding. With larger Generation Systems which remain in parallel with CPE’s system, a transfer trip system may be required to sense the loss of CPE’s system source. When CPE’s system source is lost, a signal is sent to the Generation System to separate the Generation from CPE’s system. The size of the Generation System vs. the capacity and minimum loading on the feeder will dictate the need for transfer trip installation. CPE’s system interconnection study of the Generation System installation will identify the specific requirements.

If multiple power sources of multiple points of sectionalizing are available on CPE’s system, then more than one transfer trip system may be required. The area EPS interconnection study will identify the specific requirements. For some installations the alternate CPE source(s) may not be utilized except in rare occasions. If this is the situation, the Interconnection Member may elect to have the Generation System locked out when the alternate source(s) are utilized, if agreeable to CPE.

i. Parallel limit timing relay (IEEE Device 62PL) set at a maximum of 120 seconds for soft transfer installations, shall trip the Generation System circuit breaker on limited parallel interconnection systems. Power for the 62 PL relay must be independent of the transfer switch control. The 62 PL timing must be an independent device from the transfer control and shall not be part of the generation PLC or other control system.
XIV. Agreements

A. Interconnection Agreement – This agreement is required for all Generation Systems that parallel at any time with CPE’s system. This agreement contains the terms and conditions upon which the Generation System is to be connected, constructed and maintained, when operated in parallel with CPE’s system. Some of the issues covered in the interconnection agreement are as follows:

1. Construction Process

2. Testing Requirements

3. Maintenance Requirements

4. Firm Operating Requirements such as Power Factor

5. Access requirements for CPE’s system personnel

6. Disconnection of the Generation System (Emergency and Non-emergency)
7. Term of Agreement

8. Insurance Requirements

9. Dispute Resolution Procedures

B. Operating Agreement – For Generation Systems that normally operate in extended parallel with CPE’s system, an agreement separate from the Interconnection Agreement, called the “Interconnection Operating Agreement”, may be created. This agreement would be created for the Benefit of both the Interconnection Member and CPE and would be agreed to between the Parties. This agreement would be dynamic and would be intended to be updated and reviewed annually. For some smaller systems, the operating agreement could simply be a letter agreement; for larger and more integrated systems the operating agreement would tend to be more involved and more formal. The operating agreement would cover items that are necessary for the reliable operation of both the Interconnecting Member’s and CPE’s systems. The items typically included in an operating Agreement are as follows:

1. Emergency and normal contact information for both CPE’s Power Control center and for the Interconnection Member.

2. Procedures for periodic Generation system test runs.

3. Procedures for maintenance on CPE’s system that affect the Generation System.


C. Maintenance Agreement – Each Generation System interconnection will be unique and will require a unique Maintenance Agreement. It is envisioned that this Exhibit will be tailored for each Generation System Interconnection. It is also intended that this Maintenance Agreement Exhibit will be reviewed and updated periodically to allow the maintenance of the Generation System to be changed to meet the needs of both Clearwater-Polk and the Interconnection Member, provided that such change does not negatively affect the other Party. There may also be changes required by outside issues such as changes in MAPP, FERC and MISO requirements and/or policies which will require this agreement to be modified.

Issues defined in this agreement will include:

1. Routine Maintenance Requirements
   a. Who is providing maintenance and their contact information
   b. Periods of maintenance
2. Modification of the Generation System – The Interconnection Member shall notify Clearwater-Polk in writing of plans for any modification to the Generation System interconnection equipment at least twenty (20) business days prior to undertaking such modifications. Modifications to any of the interconnection equipment, including all required protective systems, the generation control systems, the transfer switches/breakers, VT’s & CT’s, generating capacity and associated wiring shall be included in the notification to Clearwater-Polk. The Interconnection Member agrees not to commence installation of any modifications to the Generating System until Clearwater-Polk has approved the modification in writing. Clearwater-Polk shall have a minimum of five (5) business days and a maximum of ten (10) business days to review and respond to the modification after the receipt of the information required to review the modifications.

D. Electric Service Agreement – This agreement will pertain to those systems which are interconnected to CPE’s system for extended periods of time for the purpose of reselling electrical energy to CPE. Each agreement will be unique to the installation for which it is written and contain the terms and conditions on the sale of the energy between the Interconnection Member and CPE.

XV. Testing Requirements

A. Protective Relaying and Equipment Related to Islanding

1. Generation System shall be equipped with protective hardware and/or software designed to prevent the Generation from being connected to a de-energized CPE system.

   The Generation may not close into a de-energized CPE system and protection must be provide to prevent this from occurring. It is the Interconnection Member’s responsibility to provide a final design and to install the protective measures required by CPE. CPE will review and approve the design, the types of relay specified, and the installation. Mutually agreed upon exceptions may at times be necessary and desirable. It is strongly recommended that the Interconnection Member obtain CPE’s written approval prior to ordering protective equipment for parallel operation. The Interconnection Member will own these protective measures installed at their facility.

2. The Interconnection Member shall obtain prior approval from CPE for any revisions to the specified relay calibrations.

B. Commission Pre-testing

The following tests shall be completed by the Interconnection Member for all transfer designs except open transition. All of the required tests in each section shall be completed prior to moving on to the
next section of tests. CPE has the right to witness all field testing and to review all records prior to allowing the system to be made ready for normal operation. CPE shall be notified with sufficient lead time to allow the opportunity for its personnel to witness any or all of the testing.

The following tests are required to be completed on the Generation System prior to energization by the Generator or CPE’s system. Some of these tests may be completed in the factory if no additional wiring or connections were made to that component. These tests are marked with an “*”:

1. Grounding shall be verified to ensure that it complies with this standard, the NESC and the NEC.

2. *CTs (Current Transformers) and VTs (Voltage Transformers) used for monitoring and protection, Shall be tested to ensure correct polarity, ratio and wiring.

3. CTs shall be visually inspected to ensure that all grounding and shorting connections have been removed where required.

4. Breaker/Switch Tests – Verify that the breaker or switch cannot be operated with interlocks in place or that the breaker or switch cannot be automatically operated when in manual mode. Various Generation Systems have different interlocks, local or manual modes, etc. The intent of this section is to ensure that the breaker or switch controls are operating properly.

5. *Relay Tests – All protective relays shall be calibrated and tested to ensure the correct operation of the protective element. Documentation of all relay calibration tests and settings shall be furnished to CPE.

6. Trip Checks – Protective relaying shall be functionally tested to ensure the correct operation of the complete system. Functional testing requires that the complete system is operated by the injection of current and/or voltage to trigger the relay equipment and proving that the relay element trips the required breaker, lockout relay or provides the correct signal to the next control element. Trip circuit shall be proven through the entire scheme (including breaker trip).

For factory assemble systems such as inverters, the setting of the protective elements may occur at the factory. This section requires that the complete system including the wiring and the device being tripped or activated is proven to be in working condition through the injection of current and/or voltage.

7. Phase Tests – The Interconnection Member shall work with CPE to complete the phase test to ensure proper phase rotation of the Generation and wiring.
8. Synchronizing Test – The following tests shall be done across an open switch or racked out breaker. The switch or breaker shall be in a position that it is incapable of closing between the Generation System and CPE’s system for this test. This test shall demonstrate that at the moment of the paralleling-device closure, the frequency, voltage and phase angle are within the required ranges, stated in IEEE 1547. This test shall also demonstrate that if any of the parameters are outside of the ranges stated, the paralleling-device shall not close. For inverter-based interconnected systems this test may not be required unless the inverter creates fundamental voltages before the paralleling-device is closed.

C. On-Line Commissioning Test – The following tests will proceed once the Generation System has completed pre-testing and the results have been reviewed and approved by CPE. The Generation System shall be functionally verified for specific interconnection as follows:

1. Anti-Islanding Test – For Generation Systems that parallel with the utility for longer than 100msec.

2. The Generation System shall be started and connected in parallel with CPE’s system source.

3. CPE’s system source shall be removed by opening a switch, breaker, etc.

4. The Generation System shall either separate with the local load or stop generating.

5. The device that was opened to removed CPE’s system source shall be closed and the Generation System shall not re-parallel with CPE’s system for at least 5 minutes.

6. Periodic Testing and Record Keeping

   a. Any time the interface hardware or software, including protective relaying and generation control systems are replaced and/or modified, CPE shall be notified. This notification shall, if possible, be with sufficient warning so that CPE can be involved in the planning for the modification and/or witness the verification testing. Verification testing shall be completed on the replaced and/or modified equipment and systems. The involvement of CPE will depend upon the complexity of the Generation System and the component being replace and/or modified. Since the Interconnection Member and CPE are now operating an interconnected system, it is important for each to communicate changes in operation, procedures and/or equipment to ensure the safety and reliability of the Member’s and CPE’s system.

   b. All closed transition transfer installations shall be inspected by CPE every five years from the initial date of installation. All soft loading transfer installations shall be inspected by CPE every three years from the initial date of installation. The inspection process shall include an on-site
review of the installation, review of any maintenance work performed on the installation, and
testing of all relays. The Interconnection Member shall be responsible for all relay testing costs
(see Commission Testing for more information). Periodic test reports and a log of inspections
shall be maintained by the Interconnection Member and made available to CPE upon request.
CPE shall be notified prior to the period testing of the protective systems so that it may witness
the testing if so desired.

c. Verification of inverter connected systems rated 15kVA and below may be completed as
follows. The Interconnection Member shall operate the load break disconnect switch and verify
the Generator automatically shuts down and does not restart for at least 5 minutes after the
switch is closed.

d. Any system that depends on a battery for trip/protection power shall be checked and logged
once per month for proper voltage. Once every four years the battery(s) must be either
replaced or a discharge test performed. Longer intervals are possible through the use of “station
class batteries” with CPE approval.
CLOSED TRANSITION “MAKE-BEFORE-BREAK”