Section G4: OPERATING PROCEDURES FOR TRANSMISSION GENERATION ENTITIES

PURPOSE

The purpose of this section is to provide generators with a general understanding of applicable PG&E and the California Independent System Operator (CAISO) operating procedures. PG&E and the generator must be in agreement on specific operating parameters before the generator is allowed to interconnect with the grid.

Applicability

The operating procedures of this section apply to all generators interconnecting with the CAISO Controlled Grid. For all other Generation Entities, including Participating generators, the PG&E agreement may not include certain provisions of this section, such as energy reporting, paralleling/separating, and Ancillary Services (handled by Scheduling Coordinators), and maintenance scheduling (handled by the CAISO). Such provisions, which are described in the CAISO Tariff, will be covered under separate agreements between the generator and these entities. In the future, and subject to appropriate regulatory approval, the CAISO may develop additional procedures applicable to certain interconnections. If conflicts arise between the PG&E operating procedures and the CAISO's procedures, the CAISO procedures shall take precedent subject to resolution through the CAISO ADR processes.

G4.1. JURISDICTION OF THE CAISO AND THE PG&E GRID CENTER (GCC)

On March 31, 1998 the CAISO assumed operational control over most of PG&E's 60 Kv and above transmission grid. Notwithstanding the operational jurisdiction of the CAISO over most of the PG&E transmission system, the CAISO Protocols delegate certain operational activities to PG&E on selected parts of the CAISO Controlled Grid. Under the CAISO's control and instruction, PG&E performs all physical switching operations, including de-energization and restoration of PG&E-owned facilities.

PG&E continues to serve as the primary point of contact for Generation Entities that are connected to the CAISO Controlled Grid and will communicate and coordinate with the CAISO, as specified in the CAISO's Protocols, Operating Procedures and tariffs.

The Generation Entity, while operating its facility interconnected with the CAISO Controlled Grid or the PG&E system, shall at all times follow the operating instructions of the CAISO and PG&E. The Grid Control Center (GCC) shall be responsible for implementing the CAISO's Orders, Protocols and Operating Procedures. The GCC may delegate the communication of operating instructions for Generation Entities to the designated PG&E Area Operations Center (AOC).

G4.2. COMMUNICATIONS

The generation customer shall maintain telephone service at the Generating Facility. If the facility is remote or unattended, telephone service shall be provided to the nearest

location normally occupied by the entity responsible (acting on its own behalf or through its designated Generating Facility operator). PG&E and the Generating Facility operator shall maintain operating communications through the designated PG&E Electric Control Center. The Generating Facility operator shall be accessible at all times and shall provide to the designated PG&E Electric Control Center a 24-hour phone number where the facility operator may be reached. The facility operator shall maintain, in a prominent location, the name of the designated PG&E Electric Control Center along with applicable instructions and a list of necessary telephone numbers and coded alarms for such Generating Facility.

G4.2.1. Daily Capacity and Energy Reports

Generation Entities whose facilities may produce 1000 kW or more must provide data, via telemetry, to the CAISO according to the requirements of the CAISO Tariff. PG&E may also require telemetry of data depending on the number of generators and the complexity of the transmission configuration. The Generating Facility operator shall provide and maintain the data circuits required for telemetering. When such telemetering is inoperative, the facility operator shall report to the designated PG&E Electric Control Center on a daily basis the voltage reading and the real and reactive power quantities delivered each hour and the energy delivered each day.

G4.2.2. Voltage Control Operation and Other Service Requirements

The Generating Facility operator shall operate any voltage control (i.e., generator controls, shunt capacitors) at the direction of the designated PG&E Electric Control Center and in accordance with the provisions of applicable agreements, applicable tariff(s), CAISO requirements and other electric service schedules. The facility operator shall post voltage orders from the designated PG&E Electric Control Center prominently so that any relief or backup operator is aware of the current PG&E voltage instruction. The Generation Entity is responsible for the safe operation and interruption and de-energization of the generator-owned voltage control devices.

If a Generating Facility; a) becomes separated from the power system and is carrying a portion of system load (islanded operating condition), and b) is unable to communicate with the designated PG&E Electric Control Center or the PG&E Grid Control Center (GCC), the generator shall be set to operate for unrestrained governor operation and maintain normal frequency and voltage until communications are restored.

Prime movers for generators with power system stabilizers shall be operated on free governor, unless the Generating Facility operator and the CAISO system dispatcher otherwise agree for a temporary period. The standard governor droop setting shall be 5 percent.

If the Generation Entity is participating in any interruptible service schedule, the Generating Facility operator must be capable, through additional equipment, of controlling generation to respond to system or local load conditions or system frequency deviations or other direct or automatic control from the CAISO. In

addition, where identified in the interconnection study, the Generating Facility may be required to participate in a remedial action scheme to maintain or enhance the operating capability or performance of the PG&E electric system.

Whenever primary relays or protective devices are out of service, backup or secondary relays must be available to clear faults. If the backup relays malfunction, the Generation Entity must provide a designated representative in readiness to manually perform necessary operations. When restoring any relays that have been out of service, the Generating Facility designated representative shall verify that the contacts of any such relays, which are normally open, are in fact open. Generating entity must ensure that relays do not have standing trip output. Note: The CAISO may have additional requirements for systems designated as CAISO Grid Critical Protective Systems. Refer to the CAISO Tariff available on the CAISO website.

G4.2.3. Paralleling to and Separating from PG&E (Attended Generating Facilities Only)

The Generating Facility designated representative shall notify the Designated PG&E Electric Control Center prior to paralleling or separating from the PG&E system. For unexpected separations, the generator designated representative will inform the Designated PG&E Electric Control Center of the nature of the problem (i.e., overvoltage, underfrequency, ground fault, remedial action, etc.) and report on any relay target operations. See Section G4.3 for unattended generation facilities with automatic or remotely initiated paralleling.

General guidance on acceptable voltage ranges to parallel can be in the following table (in alignment with IEEE2800-2022 Section 4.10.2 Table 3)

Enter Service Criteria		
Applicable voltage within range	Minimum value	0.90 p.u
	Maximum value	1.10 p.u.

Per unit values are based on nominal values of the PG&E Transmission System. For the PG&E 500 kV system, the nominal value is 525 kV.

G4.2.4. Clearances and Switching Requests

The Generating Facility operator must request a clearance from PG&E with sufficient time for all regulatory review and approvals. In many cases this is 45 to 60 days. When possible PG&E will work to minimize that timeline that is within PG&E's control but not less than one week (seven calendar days) in advance. PG&E shall notify the Generating Facility one week (seven calendar days) in advance of any plans to take a clearance which affects the Generating Facility.

Each interconnected facility shall have installed an approved disconnect or other switching device for operation by the Generating facility as a clearance point.

Thedisconnect must be capable of being locked open and accessible to PG&E personnel.

G4.2.5. Unusual or System Emergency Conditions

For all System Emergencies, the CAISO is responsible for managing the emergency and for restoration as specified in the CAISO Tariff. All Generating Units and System Resources that are owned or controlled by a Participating Generator are (without limitation to the CAISO's other rights under this CAISO Tariff) subject to control by the CAISO during a System Emergency and in circumstances in which the CAISO considers that a System Emergency is imminent or a threat. The CAISO shall, subject to CAISO Tariff Section 5.6.2, have the authority to instruct a Participating Generator to bring its Generating Unit on-line, off-line, or increase or curtail the output of the Generating Unit and to alter scheduled deliveries of Energy and Ancillary Services into or out of the CAISO Controlled Grid, if such an instruction is reasonably necessary to prevent an imminent or threatened System Emergency or to retain Operational Control over the CAISO Controlled Grid during an actual System Emergency.

PG&E is responsible for complying with all directions from the CAISO regarding management and alleviation of the System Emergency, unless such compliance would impair the health and safety of personnel or the general public. As directed by the CAISO, PG&E will be responsible for communicating with Generation Entities regarding emergencies. Unusual operating conditions or other factors that have affected or may affect the CAISO Controlled Grid or PG&E's electric system (e.g., abnormal voltages or loading or unbalanced loading) must be reported to the Designated PG&E Electric Control Center as soon as possible. Conditions imperiling life or property shall be reported to the designated PG&E Electric Control Center immediately. The Designated PG&E Electric Control Center shall be notified of any forced outage. The Designated PG&E Electric Control Center shall notify the Generating Facility of any unusual CAISO Controlled Grid or PG&E conditions that may affect the customer's facility. During any emergency the facility operator shall follow the instructions of the designated PG&E Electric Control Center. Interruptible Generation Entities may not re-parallel until authorized by the Designated PG&E Electric Control Center.

G4.2.6. Emergency/Backup Generators

For additional emergency generator paralleling requirements, refer to Section G2.14.

G4.2.7. Other Communications

The facility operator shall notify the designated Account Manager of the following:

- Any replacement, modification or removal of any interconnection generation facilities (i.e., transformer, breaker, changes in EMS/SCADA, disconnect, relays, remedial action equipment, etc.).

Note: Regardless of generator size, protective equipment designated as CAISO Grid Critical Protective devices utilize special CAISO procedures, as specified in the CAISO Tariff.

The facility operator shall follow the manufacturer's minimum maintenance requirements on file for audit by the PG&E Designated Substation Maintenance Supervisor:

- Results of three-year or four-year bench tests on all PG&E-required relays.
- Results of six-year or eight-year tests on interconnection circuit breakers and transformers.
- Results of instrument transformers, such as potential and/or current transformers, associated with the PG&E required relays.

The facility operator shall notify the designated PG&E Electric Control Center:

- **The time of any relay operations and targets of the relay that caused the Generating Facility to separate, if applicable.**
- **The time of any paralleling with and separations from the PG&E system.**
- **The time of the change in voltage-control device set points (if applicable) and the time of change in the operating status (i.e., opened or closed) of any other voltage-control device (i.e., shunt capacitors or reactors).**

Note: These three items in boldface type are information an event recorder at an unattended facility must be able to provide to PG&E, and are referred to in Section G4.3.3.

G4.3. UNATTENDED GENERATING FACILITIES

G4.3.1. Verification of Energized Circuit

An unattended Generating Facility with remotely initiated restoration must consult with the designated PG&E Electric Control Center prior to re-parallel. PG&E must confirm that the circuit to which the generation facility will be paralleled is energized by a PG&E-approved source of energy.

G4.3.2. Loss of Power/Automatic Re-paralleling

All unattended Generating Facilities with automatic or remotely initiated paralleling must have the following capabilities in the event of loss of power:

- Relays must have the capability of retaining targets on loss of power, or an event recorder must be provided which will permanently record all relay target information including time and duration.
- Automatic re-paralleling must be accomplished in less than 5 minutes after the initial trip. If a re-parallel attempt after the initial trip is unsuccessful, the automatic re-paralleling equipment must lock-out. No subsequent re-paralleling attempt shall be made under any of the following conditions:

- One unsuccessful attempt to re-parallel was made.
- A successful re-parallel was followed by a subsequent trip within 5 minutes due to lack of electrical potential on the circuit to which the Generating Facility would be connected.

Unattended Generating Facilities with automatic initiated connection are not required to notify the designated PG&E Electric Control Center prior to making an automatic initiated parallel with the CAISO Controlled Grid or the PG&E system or following an automatic separation, unless a lock-out condition has occurred.

After any separation from PG&E's system, if automatic re-paralleling equipment has locked out or if the connection was separated manually, the Generation Entity may not re-parallel either automatically or manually until authorized by the designated PG&E Electric Control Center.

G4.3.3. Event Recorder

All unattended Generating Facilities with capability greater than 1.0 MW and with automatic or remotely initialed paralleling capability must have an event recorder recorder that will enable PG&E to make an after-the-fact determination of the status of the Generating Facility at the time of the system disturbance, should such a determination be required. The events should be recorded to a one (1) milli-second resolution.

The Generating Facility shall ensure the time reading is correct and synchronized to an accurate time standard. The event recorder or other recording device(s) at the Generating Facility must be capable of providing a record of the information specified in the three items in Section G4.2.7 which are in boldface type. In addition, for generation facilities with a nameplate rating equal to or greater than 1,000 kW, the event recorder must also provide a record of deliveries to PG&E of real power in kW and reactive power in kVar and output voltage in kV.

G4.4. PROCEDURES ON TRANSFER TRIP PROTECTION FOR GENERATION FACILITIES

These procedures describe the interaction between PG&E and generation facilities when malfunctions of transfer trip (TT) protection schemes occur. The procedures apply to all generation facilities with transfer trip protection that have a direct connection, at any voltage level, to the CAISO Controlled Grid or the PG&E system.

G4.4.1. Purpose and Definition

There is a potential risk to both PG&E generation facilities and non-PG&E owned generation facilities when a generator's TT protection is out of service. This risk includes, but is not limited to:

- The generator would continue to feed a fault on a line after the line has relayed and is no longer connected to the rest of the CAISO Controlled Grid or the PG&E system, thereby endangering life and property. Significant damage could occur to the generator and associated equipment.

- The generator would continue to feed a fault on a line for a longer period of time, thereby risking equipment damage and reducing reliability.

All generators having TT protection shall be classified by level of risk in one of two categories:

- **Type A** (inadequate back-up protection). The generator's back-up protective relays cannot see end-of-line faults and as such represent a hazard, as described above, while TT protection is out of service.
- **Type B** (adequate back-up protection). The generator's back-up protective relays can see end-of-line faults, but will separate the generator from the system more slowly than with the TT protection in service.

G4.4.2. Separation Following Loss of Transfer-Trip Protection

The following standard applies to all generators that have TT protection

- **Type A** (inadequate back-up protection) generation facilities shall separate from PG&E's system immediately upon loss of TT protection. Generators that have two or more PG&E TT terminals are not required to separate immediately if the remaining TT channel(s) provide back-up protection.
- **Type B** (adequate back-up protection) generation facilities will be allowed to remain on-line, provided they restore the TT protection to working order within seven calendar days and initiate repairs within 24 hours of loss of TT protection.
- Repeated intermittent TT failures (regardless of Type A or Type B category) may indicate that the TT is unreliable. In such cases, the Designated PG&E Electric Control Center will notify the Generating Facility that it has seven days to restore the TT scheme to reliable operation. If at the end of seven days this has not been done, the generator must then immediately separate from the CAISO Controlled Grid or the PG&E system.
- A small number of Type A generators have a protection scheme designed to trip the generator automatically when TT protection is lost. The procedures set forth in this document apply to these generation facilities, except that the "order to separate" described below need not be issued because the generator will have already been separated from the system when the TT protection is lost.

G4.4.3. Procedures

When the Generating Facility is made aware of loss of Transfer-Trip protection, they shall notify the designated PG&E Electric Control Center. If the Designated Electric Control Center receives a "TT channel failure" alarm and has not been notified by the Generating Facility, the Designated PG&E Electric Control Center will attempt to contact and notify the Generating Facility operator that transfer trip has been lost. Contact with the Generating Facility will be considered to have been made if the Designated PG&E Electric Control Center has called the listed

phone number for the Generating Facility and a fax of the orders/notification has been sent to the facility.

- **Type A**: The Designated PG&E Electric Control Center will order a Type A Generating Facility to immediately separate from the CAISO Controlled Grid or the PG&E system.
- **Type B**: The Designated PG&E Electric Control Center will direct a Type B Generating Facility to remain on-line provided it begins repair work within 24 hours and restores TT protection to working order within seven calendar days. Type B facilities must report back to the Designated PG&E Electric Control Center, by phone or fax, to confirm that repair work was in fact initiated within 24 hours of the notification. At the end of seven days, if the TT protection scheme has not been restored, the Designated PG&E Electric Control Center will order the Generating Facility to immediately separate from the CAISO Controlled Grid or the PG&E system.

G4.4.4. Separation Orders

All conversations regarding PG&E notifications and separation orders shall be logged by both the Designated PG&E Electric Control Center and Generating Facility Operators. The log shall include as a minimum: date, time, names of both operators, the reason for the separation order, switch number(s) to be opened and any other pertinent information.

Upon completion of separation, the facility operator shall report back to the Designated PG&E Electric Control Center, confirming the time separation was completed. The “Report of Completion” conversation shall be logged to include the items specified in the preceding paragraph.

G4.4.5. Non-Compliance Separation Order

It is critical to both parties' interests that a Generating Facility separates from PG&E's system upon receipt of separation orders. Failure to comply with a separation order following loss of TT protection is unacceptable. CAISO

- Type A: If the non-compliant Generating Facility fails to comply with a separation order, the Designated PG&E Electric Control Center will take immediate action to separate it from the CAISO Controlled Grid or the PG&E system.

G4.4.6. Re-parallel of Generating Facility After Restoration of TT Protection

Before a Generating Facility is allowed to re-parallel with the CAISO Controlled Grid or the PG&E system after having received separation orders from PG&E for the loss of TT protection, one of the following criteria must be satisfied:

1. If the loss of TT protection was caused by hardware or communication path change, the PG&E Protection Engineer must authorize and notify the

Designated Control Center that TT protection has been restored to proper operation.

2. If the loss of TT protection was caused by communication circuit failure only, and after the TT circuit is repaired and tested, the Designated PG&E Electric Control Center operator will give an OK to cut in the transfer trip and re-parallel the generator if necessary.

G4.5. GENERATION ENTITY INTERFERENCE WITH POWER QUALITY

Under Electric Rule 21 and IEEE Standard 519, the Generating Entity is responsible for operating its facilities and equipment to avoid unacceptable interference which may adversely affect PG&E's operations or service provided to other customers, whether by voltage fluctuations, harmonics, or inductive interference. As an example, total voltage harmonic distortion may not exceed 5 percent. The Generation Entity is responsible for the costs of mitigating any interference it causes.