

## **Section L5: PRE-ENERGIZATION TEST PROCEDURES FOR LOAD-ONLY ENTITIES AND TRANSMISSION-ONLY ENTITIES**

### ***PURPOSE***

The following is PG&E's procedure for pre-energization inspections. For PG&E to provide the Load Entity or Transmission Entity with timely service it is important that all time requirements be met. It is the Load Entity's or Transmission Entity's responsibility to ensure that any inspections required by local government agencies are complete and permits signed off prior to the energize date. If the interconnection involves both generation and load, or both generation and transmission, or transmission facilities interconnecting network that connects to generation, then Section G5 shall also apply.

***NOTE:*** The following tests apply only to the equipment at the interconnection point, up to and including the main transformer, and the relays along with their connected circuits that are required by PG&E. Items marked (\*\*\*) are the common requirements for both fused substations and substations protected by breakers or circuit switchers. Fused substations need meet only the requirements marked (\*\*\*)

### ***L5.1. TESTS REQUIRED FOR LOAD ENTITIES PRIOR TO ENERGIZING***

All tests outlined through sections L5.1.1.- L5.1.7. must be completed and an electronic or hard copy of the test reports submitted to a PG&E representative a minimum of thirty (30) business days before the requested pre-parallel inspection date. All test reports require header information reflecting the equipment identification matching the one or three line diagrams. DC schematics, one line and three line diagrams, of the facility are required with the test reports. Pre-parallel inspection dates will be scheduled a minimum of ten (10) business days after all test reports are approved by PG&E. Failure to meet PG&E approved test requirements will result in delay of energizing pre-parallel inspection and testing of generation entity's equipment.

#### **L5.1.1. Proving Insulation**

For any of the megger tests below, a 2,500-volt DC megger or a hi-pot is preferred, but a 1,000-volt DC megger is acceptable.

- (\*\*\*) The main transformer(s) must be meggered winding to winding and each winding to ground.
- The circuit breaker(s) or circuit switcher(s) at the interconnection point that are operated by PG&E-required relays must be meggered in the following manner:
  - a) Breaker open: each pole to ground, pole 1-2, pole 3-4, pole 5-6;
  - b) Breaker closed: pole 1-ground, pole 3-ground, pole 5-ground; and
  - c) If the poles are in a common tank or cell: pole 1-3, pole 3-5, pole 5-1.
- (\*\*\*) All busses from the interconnection point to the main transformer must be meggered phase to phase and phase to ground.

- (\*\*\*) The main transformer(s) and main breaker(s) must have a dielectric test performed on the insulating medium (gas or oil). This test is not required for factory-sealed circuit switcher interrupters.
- (\*\*\*) If the main transformer is fused, all fuses must be checked for continuity before energizing.

#### **L5.1.2. Proving Ratios**

- (\*\*\*) The main transformer(s) ratio(s) must be proven either by using a turns ratio tester or a voltage ratio test on the final operating tap. This tap shall be recommended by PG&E to best match current transmission system voltages.

#### **L5.1.3. Circuit Breakers and Circuit Switchers**

- A minimum to trip test at 70 percent or less of the nominal DC control voltage must be performed on all circuit breakers or circuit switchers operated by PG&E-required relays.
- A micro-ohm test must be performed on the main circuit breaker(s) or circuit switcher(s) at the interconnection point.
- A timing test showing the time from trip initiation to main poles opening is required.

#### **L5.1.4. Current Transformers and Current Circuits**

- A saturation check should be made on all current transformers (CT's) associated with the required PG&E relays. If this is not possible, a manufacturer's curve is acceptable.
- The ratio of all current transformers must be proven either by using current (primary to secondary) or voltage (secondary to primary).
- Current transformers must be checked for proper polarity whenever they feed a PG&E-required directional relay, differential relay or impedance relay.
- Current transformer circuits must be checked for proper connections, and continuity must be checked by applying primary current or secondary current at the current transformer block and reading proper current in each phase relay and the ground relay. Each test (primary or secondary) must be performed in all combinations to prove proper connections to all phase relays and ground relays. The current must be applied or injected to achieve a secondary reading of 5 amps in each relay to insure that no loose wiring or parallel current paths exist.
- A single-phase burden check must be made on each phase of each current circuit feeding PG&E-required relays.
- A megger check of the total circuit with the ground wire lifted must be done to prove that only one ground exists.

### **L5.1.5. Relays**

- All relays must be utility grade and PG&E-approved. If multi-functional relaying is used, some form of redundancy is required.
- All relays must be field tested on site to their specified settings to verify the following:
  - Minimum operating point at which relay picks up (minimum pickup).
  - Time delays at three different current test points, in integral multiples of minimum pickup that closely characterize the relay time-current curve.
  - Phase angle characteristic of directional relay.
  - Pickup points at maximum torque angle (MTA) and  $\pm 30^\circ$  of MTA on impedance relays using the approved relay settings.
- PG&E tolerances are listed below:
  - Current/Voltage/Time  $\pm 10$  percent
  - Impedance/Phase Angle  $\pm 0.05$  percent
  - Frequency  $\pm 0.05$  Hz
- If a pilot relay system is required by PG&E, signal level checks must be performed to PG&E standards.

### **L5.1.6. Primary Disconnect Switch**

- (\*\*\*) The primary disconnect switch at the point of interconnection shall be assigned a PG&E number by PG&E System Operations. The switch, platform and switch number target plate bracket must be constructed to PG&E's Engineering Standard 034851 and Engineering Design Standard 454092. A switch number plate bracket shall be furnished by PG&E.

### **L5.1.7. Station Battery**

- When a battery is installed, proof of discharge testing is required to ensure that the battery has the capacity to support the load and trip (see [Appendix T](#))

## **L5.2. ENERGIZING**

- (\*\*\*) If possible, initial energizing of all equipment shall be done with a proven PG&E breaker. A test program outlining all steps to be taken to energize the equipment shall be written by a PG&E representative.
- Trip checks of all required relays must be witnessed by a PG&E technical representative. This may require injecting a signal to trigger the relay. Jumpering the studs on the back of the relay is not acceptable. This is done to prove that the relay will handle the trip current of the breaker, and also provides relay targeting.

- After load is placed on the substation a PG&E technical representative shall witness reading of load current in each phase relay and absence of load current in the ground relay. The relays shall then be sealed by the PG&E technical representative.
- If differential relays and/or impedance relays are required by PG&E, a load check must be performed on the differential relays and a direction check must be performed on the impedance relays using load current. These tests shall be witnessed by a PG&E technical representative.
- All tests shall be performed by the Load Entity or its representative and observed by a PG&E representative. The Load Entity shall provide all test equipment and qualified personnel to perform the required tests. PG&E shall be there strictly as an observer.

### **L5.3. GENERAL NOTES**

- The PG&E system has A-C-B counterclockwise rotation.
- Any changes to PG&E-required protection equipment or major substation equipment (transformer, breaker, etc.) must be submitted to the PG&E representative for review and approval by the appropriate PG&E engineer prior to the changes being made. In order to energize new equipment, the Load Entity must follow the pre-parallel inspection process.
- Routine maintenance on PG&E-required protective relays and the breaker(s) must meet PG&E's maintenance and test practices. After completion of these tests, test reports must be submitted to the PG&E representative for review and approval by the appropriate PG&E engineer. A PG&E technical representative shall then come to the customer's facilities and reseal the PG&E-required relays.
- Questions shall be directed to the local PG&E representative.

**Contact Information Sheet**

**PG&E STATION CONSTRUCTION TEST DEPARTMENT  
BASIC INFORMATION REQUIREMENTS**

Project Name			
Site Address			
Proposed PPI Date/Time	Date:	Time:	AM / PM
Type of Unit(s)			
Number of Units			
MW or kW			
Job Accounting #			
Operation #			

**PG&E CONTACTS**

Project Manager			
Phone #:	Cell #:	Email:	

Planning Engineer			
Phone #:	Cell #:	Email:	

Sys. Prot. Engineer			
Phone #:	Cell #:	Email:	

Switching Center			
Phone #:			

**CLIENT CONTACTS**

Project Manager			
Phone #:	Cell #:	Email:	

Site Contact			
Phone #:	Cell #:	Email:	

Design Engineer			
Phone #:	Cell #:	Email:	

Testing Company			
Phone #:			
Tester Name:			
Phone #:	Cell #:	Email:	

## **BASIC NEEDS ASAP**

### **MINIMUM TWO (2) WEEKS PRIOR TO REQUESTED PPI DATE**

- SINGLE-LINE METER AND RELAY DRAWING
- THREE LINE DRAWING
- DC SCHEMATIC (SHOWING TRIP & CLOSE CIRCUITS)
- COMPLETED AND ACCURATE DG-5 / PS-1 FORM (Approved by Planning / Protection Engineer)
- ANY & ALL TEST REPORTS AS OUTLINED IN SECTION G5 OF INTERCONNECTION HANDBOOK
- COPY OF ALL PERTINENT LETTERS / EMAILS THAT AFFECT CONTROL & PROTECTION AS AGREED TO BY PG&E