
Appendix G

Preliminary Protection Requirements

PANOCHÉ ENERGY CENTER PROJECT
SYSTEM IMPACT RE-STUDY
PRELIMINARY PROTECTION REQUIREMENTS
REVISED 10-24-06

The following Preliminary Protection Requirements are for estimating purposes only of the Panoche Energy Center Project. The actual relays specified in the final protection requirements may differ from those outlined in this document.

Per Section G2.1 of the PG&E Interconnection Handbook, PG&E protection requirements are designed and intended to protect PG&E's system only. Generation Entity is responsible for the protection of its own system and equipment and must meet the requirements in the PG&E Interconnection Handbook.

ASSUMPTIONS:

- 1) The Panoche EC Facility will consist of four gas turbine generator each rated at 102.5MW with a plant auxiliary load of 9 MW. **Each generator will have it's own GSU rated at 125MVA each.** With a maximum net output of 401 MW.
- 2) This generation will be connected to the Panoche 230kV bus via approximately 1000 Feet of 795 ACSS conductor.
- 3) The existing Panoche 230kV bus configuration is a double bus single breaker configuration.
- 4) Due to the very short length of the overhead 230kV interconnection between PG&E Panoche substation and Panoche EC Facility, a fully redundant, double-pilot current differential protection scheme utilizing dual fiber optic communications will be required to achieve coordination with all lines connected Panoche 230kV Substation.
 - a. Note: PG&E does not recommend using Overcurrent protection for this tie line. To coordinate with the lines into Panoche 230kV substation, it would be necessary to set the Overcurrent relay with instantaneous protection. This relay would operate instantaneously for faults on the generation tie line and in the generation facility. In the case of faults with in the facility, faults will be cleared by both the facility protective devices and the remote tie line breaker resulting in the unnecessary loss of the whole generation facility. This will, also, prevent accurate fault location and delays in restoration of the generation facility for faults on the tie line and within the facility.
- 5) The D60 and 311C relay requirements are Non-Integrated solutions, thus requiring discrete breaker failure and recloser relays to be installed.
- 6) These protection requirements will not cover special protection set-ups for temporary transmission line shoo-fly configurations that may be necessary to complete this project.

- 7) Line relays specified are per existing System Protection list of relays approved for purchase. Existing Engineering Design Standards are associated with application of these relays.
- 8) Relay coordination was not reviewed for this study. Recoordination studies could result in the required replacement of relays that are determined to be out of range as a result of this interconnection.
- 9) Study is based upon existing information available, any changes to the interconnection queue, connection point, or project information will result in a restudy of the area.

PROTECTION REQUIREMENTS

The Protection Requirements will consist of a fully redundant, double-pilot current differential scheme utilizing dual fiber optic communications for the Panoche – Panoche EC 230KV Line. Due to the interconnection of the Panoche EC Facility four terminals on the Panoche 230kV Bus will require relay replacement due to CT Saturation. The details are as follows:

COMMUNICATIONS

I. Fiber Optic Links:

- A. Install dual redundant fiber optic cables between Panoche 230 kV substation and Panoche EC Facility.

PANOCHÉ SUBSTATION

The interconnection of the Panoche EC Facility to the Panoche 230kV will expose the following Panoche CB 212, CB 222, CB 332 and CB 322 to CT saturation. These terminals will require the CTR to be raised and the relays to be replaced. ***This may require replacement of relays at the remote terminals.***

In addition, the Panoche 230kV CBs do not have Breaker Failure protection. Due to this project remote terminal sensitivity will be decreased requiring all Panoche 230KV CBs to have Breaker Failure relays installed as part of this project.

I. Install Basler-BPR Breaker Failure relay on the following Panoche 230KV Breakers:

- A. Panoche CB 312
- B. Panoche CB 232
- C. Panoche CB 252
- D. Panoche CB 262
- E. Panoche CB 242

II. CB AAA: Panoche – Panoche EC 230KV Line

- A. Line Length: **Approximately 1000 feet**
- B. CB AAA: Install one-230kV SF6 circuit breakers with bushing CTs rated 3000/5 per PG&E specifications.
- C. All CTs to be pulled into the control room.
- D. Install G.E. L90 SET A current differential relay as one terminal of a three-terminal Panoche – Panoche EC pilot scheme using dual fiber optic communication line.
 - 1. Wire to outermost Bus-side CT.
- E. Install SEL 311 L SET B current differential relay as one terminal of a three-terminal Panoche – Panoche EC pilot scheme using dual fiber optic communication line.
 - 1. Wire to innermost Bus-side CT.
- F. Install Basler-BPR breaker failure relay on CB AAA
- G. Install SEL-279 reclosing relay on CB AAA
- H. Install three (3) line-side CCVTs to provide polarizing potentials for line protection and station automatics.
- I. Wire bus differential scheme to innermost line side CTs. Connect at 2000/5.

III. Parallel Breaker CB 202

- A. If substitution for CB AAA is required by customer, PG&E will utilize Overcurrent protection for the tie line. To coordinate with the lines into Panoche 230kV substation, it would be necessary to set the Overcurrent relay with instantaneous protection. This relay would operate instantaneously for faults on the generation tie line and in the generation facility. In the case of faults with in the facility, faults will be cleared by both the facility protective devices and the remote tie line breaker resulting in the unnecessary loss of the whole generation facility. This will, also, prevent accurate fault location and delays in restoration of the generation facility for faults on the tie line and within the facility.
- B. Install Basler -BPR breaker failure relay on CB 202

IV. CB 212: Los Banos – Panoche #2 230KV Line

- A. Remove existing line protection.
- B. Install G.E. D60 SET A relay as one terminal of a two-terminal Blocking scheme on power line carrier.
- C. Install SEL 311 C SET B relay as one terminal of a two-terminal Blocking scheme on power line carrier.

- D. Install Basler -BPR breaker failure relay on CB 212
 - E. Install SEL-279 reclosing relay on CB 212
 - F. Raise CTR to 2000/5.
 - G. Evaluate existing Wave Trap.
 - H. Install Pulsar TC-10B power line carrier transceiver for blocking scheme.
- V. CB 222: Dos Amigos PP – Panoche #3 230KV Line**
- A. Remove existing line protection.
 - B. Install G.E. D60 SET A relay as one terminal of a two-terminal Blocking scheme on power line carrier.
 - C. Install SEL 311 C SET B relay as one terminal of a two-terminal Blocking scheme on power line carrier.
 - D. Install Basler -BPR breaker failure relay on CB 222
 - E. Install SEL-279 reclosing relay on CB 222
 - F. Raise CTR to 2000/5.
 - G. Evaluate existing Wave Trap.
 - H. Install Pulsar TC-10B power line carrier transceiver for blocking scheme.
- VI. CB 322: Panoche - Helm 230KV Line**
- A. Remove existing line protection.
 - B. Install G.E. D60 SET A relay as one terminal of a two-terminal Blocking scheme on power line carrier.
 - C. Install SEL 311 C SET B relay as one terminal of a two-terminal Blocking scheme on power line carrier.
 - D. Install Basler -BPR breaker failure relay on CB 322
 - E. Install SEL-279 reclosing relay on CB 322
 - F. Raise CTR to 2000/5.
 - G. Evaluate existing Wave Trap.
 - H. Install Pulsar TC-10B power line carrier transceiver for blocking scheme.
- VII. CB 332: Los Banos – Panoche #1 230KV Line**
- A. Remove existing line protection.
 - B. Install G.E. D60 SET A relay as one terminal of a two-terminal Blocking scheme on power line carrier.
 - C. Install SEL 311 C SET B relay as one terminal of a two-terminal Blocking scheme on power line carrier.

- D. Install Basler -BPR breaker failure relay on CB 332
- E. Install SEL-279 reclosing relay on CB 332
- F. Raise CTR to 2000/5.
- G. Evaluate existing Wave Trap.
- H. Install Pulsar TC-10B power line carrier transceiver for blocking scheme.

PANOCHE EC FACILITY

I. CB BBB/CCC: Panoche – Panoche EC 230KV Line

- A. Line Length: **Approximately 1000 feet**
- B. CB BBB: Install one-230kV SF6 circuit breakers with bushing CTs rated 3000/5 per PG&E specifications.
- C. CB CCC: Install one-230kV SF6 circuit breakers with bushing CTs rated 3000/5 per PG&E specifications.
- D. All CTs to be pulled into the control room.
- E. Install two G.E. L90 SET A current differential relay, one dedicated to each CB as two terminals of a three-terminal Panoche – Panoche EC pilot scheme using dual fiber optic communication line.
 - 1. Wire to outermost Bank-side CT from both CBs.
- F. Install SEL 311 L SET B current differential relay, one dedicated to each CB as two terminals of a three-terminal Panoche – Panoche EC pilot scheme using dual fiber optic communication line.
 - 1. Wire to innermost Bank-side CT from both CBs.
- G. Install Basler -BPR breaker failure relay on CB BBB
- H. Install Basler -BPR breaker failure relay on CB CCC
- I. Install three (3) line-side CCVTs to provide polarizing potentials for line protection and station automatics.
- J. Install one (1) bank-side CCVTs on each transformer to provide synchronizing potential for station automatics