

PACIFIC GAS AND ELECTRIC COMPANY
Wildfire Mitigation Plans Discovery 2023-2025
Data Response

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PG&E Witness:		Requester:	Tyler Holzschuh

SUBJECT: PG&E's PLANNED FAST-TRIP SETTINGS FOR THE 2024 FIRE SEASON

QUESTION 001

For PG&E's three-wire uni-grounded primary circuits at or below 35 kV (nominal) please describe, with references to PG&E's procedures:

- a) PG&E's fast-trip (known as Enhanced Powerline Safety Settings, or EPSS) line-current² thresholds;
- b) How PG&E's fast-trip line-current thresholds are calculated from measured circuit values;
- c) The intentional delays assigned to those line-current thresholds;
- d) PG&E's fast-trip ground-current thresholds;
- e) How PG&E's fast-trip ground-current thresholds are calculated from measured circuit values;
- f) The intentional delays assigned to those ground-current thresholds; and
- g) How the current (both line and ground) and delay thresholds differ from non fast-trip settings.

ANSWER 001

PG&E's most current EPSS protection guidelines are document in TD-1470P-01 Att. 1 "Application Guide Device Profile Settings".

- a) EPSS phase overcurrent settings for line reclosers (LR) and circuit breakers (CB) are set with the following guidelines:

Phase time overcurrent (51 element)

Phase minimum-to-trip (MTT) \leq 60% three-phase fault or 70% line-to-line fault based upon simulated short circuit bolted faults at the protection zone end of line. Fuses and other single phase (non-ganged) protective devices are not included as delimiters for the purpose of establishing the protective zone. Set phase MTT greater than 1.2x maximum expected loading.

² Also known as phase-current.

Phase instantaneous/definite time overcurrent (50 element)

Phase instantaneous trip setting is set equal to the phase time overcurrent minimum to trip.

- b) PG&E's EPSS phase overcurrent trip settings are based upon short circuit analysis provided through simulation of the distribution network model. The simulations provide values to set as described in a). Maximum loading data is obtained through planning forecasts as well as historical SCADA observations.
- c) For EPSS, phase instantaneous/definite time settings are used to establish coordination delay. The time delay of the furthest protective device is set to 0ms or no intentional delay. Each consecutive source side protective device is set with an additional +0.02 to 0.05s time delay, optimizing for margin. Protective device time delays will not exceed 0.1s or 6 cycles.
- d) EPSS ground overcurrent settings for line reclosers and circuit breakers are set with the following guidelines:

Ground time overcurrent (51N/G element)

Ground minimum-to-trip (MTT) \leq 50% simulated short circuit bolted line to ground fault at the protection zone end of line. Fuses and other single phase (non-ganged) protective devices are not included as delimiters for the purpose of establishing the protective zone. Set ground MTT greater than 1.2x maximum expected normal standing ground current.

Ground instantaneous/definite time overcurrent (50N/G element)

Phase instantaneous trip setting is set equal to the phase time overcurrent minimum to trip.

Sensitive Ground Element (SGF)

The sensitive ground element (SGF) for three-wire applications is typically set between 5-15A to provide a low set ground overcurrent element to attempt to detect high impedance ground faults. The SGF setting threshold is also required to be 1.2x the maximum observed standing ground fault current due to system capacitance and configuration.

- e) PG&E's EPSS ground overcurrent trip settings are based upon short circuit analysis provided through simulation of the distribution network model. The simulations provide values to set as described in d).
- f) The ground instantaneous/definite time overcurrent time delay is set the same as the phase delay in section c). For SGF the minimum time delay is typically set from 5-15 seconds with 1-3 seconds of coordination time between devices equipped in series with SGF towards the source.
- g) Non-EPSS settings operate typically with a time-overcurrent element which may or may not also have an instantaneous or definite time element set. Non-EPSS settings also account for fuses as other non-gang trip device to delimit protective zones thereby reducing the zone of protection. The minimum separation guideline between two LR's or between LR and CB is typically 0.2s. Both EPSS and non-EPSS settings utilize the same principles of end of line fault detection and anticipated load accommodate when setting the MTT thresholds. In addition, settings are designed to

protect against equipment damage by limiting I^2t energy as well as arc-flash exposure.