



TPL-001-5.1

P5 Corrective Action Plans (CAPs)

Stan Sliwa

Lead Engineer, Transmission Planning

Reliability Standards & Compliance Subcommittee

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- TPL-001-5.1 became effective on 7/1/2023
 - First annual Planning Assessment completed in accordance with the standard but without Corrective Action Plans (CAPs) for revised P5 on time. (2022 Planning Assessment)
- NERC Implementation Plan allows for additional 24-month period (by 7/1/2025) for the development of CAPs for Category P5 planning events involving single points of failure in Protection Systems
- TPL-001-5.1 is fully enforceable by 7/1/2029

Governmental Authorities approve TPL-001-5 & Implementation Plan.

TPL-001-5 becomes effective.

- Changes to R1, R2, R4, and Table 1 enforceable.
- Requirement R2, Part 2.7 not enforceable for non-redundant components of a Protection System identified in Table 1 Category P5, footnote 13, items b, c, and d.
- R3, R5, R6, R7, R8 unchanged.
- *The first annual Planning Assessment shall be completed in accordance with TPL-001-5, but without CAPs for revised P5, by this date.*



CAPs required for all failures to meet Table 1 performance requirements, but the planned System is not required to meet the performance requirements in Table 1 for category P5 events only.

- *All Planning Assessment(s) completed after this date shall include CAPs for failures to meet Table 1 performance requirements for the revised P5, when identified.*

TPL-001-5 fully enforceable.



P5 Planning Event

TPL-001-5.1 — Transmission System Planning Performance Requirements

Category	Initial Condition	Event ¹	Fault Type ²	BES Level ³	Interruption of Firm Transmission Service Allowed ⁴	Non-Consequential Load Loss Allowed
P5 Multiple Contingency (Fault plus non-redundant component of a Protection System failure to operate)	Normal System	Delayed Fault Clearing due to the failure of a non-redundant component of a Protection System ¹³ protecting the Faulted element to operate as designed, for one of the following: 1. Generator 2. Transmission Circuit 3. Transformer ⁵ 4. Shunt Device ⁶ 5. Bus Section	SLG	EHV	No ⁹	No
				HV	Yes	Yes

Table 1 – Steady State & Stability Performance Footnotes (Planning Events and Extreme Events)

1. If the event analyzed involves BES elements at multiple System voltage levels, the lowest System voltage level of the element(s) removed for the analyzed event determines the stated performance criteria regarding allowances for interruptions of Firm Transmission Service and Non-Consequential Load Loss.
2. Unless specified otherwise, simulate Normal Clearing of faults. Single line to ground (SLG) or three-phase (3 ϕ) are the fault types that must be evaluated in Stability simulations for the event described. A 3 ϕ or a double line to ground fault study indicating the criteria are being met is sufficient evidence that a SLG condition would also meet the criteria.
3. Bulk Electric System (BES) level references include extra-high voltage (EHV) Facilities defined as greater than 300kV and high voltage (HV) Facilities defined as the 300kV and lower voltage Systems. The designation of EHV and HV is used to distinguish between stated performance criteria allowances for interruption of Firm Transmission Service and Non-Consequential Load Loss.
4. Curtailment of Conditional Firm Transmission Service is allowed when the conditions and/or events being studied formed the basis for the Conditional Firm Transmission Service.
5. For non-generator step up transformer outage events, the reference voltage, as used in footnote 1, applies to the low-side winding (excluding tertiary windings). For generator and Generator Step Up transformer outage events, the reference voltage applies to the BES connected voltage (high-side of the Generator Step Up transformer). Requirements which are applicable to transformers also apply to variable frequency transformers and phase shifting transformers.
6. Requirements which are applicable to shunt devices also apply to FACTS devices that are connected to ground.
7. Opening one end of a line section without a fault on a normally networked Transmission circuit such that the line is possibly serving Load radial from a single source point.
8. An internal breaker fault means a breaker failing internally, thus creating a System fault which must be cleared by protection on both sides of the breaker.
9. An objective of the planning process should be to minimize the likelihood and magnitude of interruption of Firm Transmission Service following Contingency events. Curtailment of Firm Transmission Service is allowed both as a System adjustment (as identified in the column entitled 'Initial Condition') and a corrective action when achieved through the appropriate re-dispatch of resources obligated to re-dispatch, where it can be demonstrated that Facilities, internal and external to the Transmission Planner's planning region, remain within applicable Facility Ratings and the re-dispatch does not result in any Non-Consequential Load Loss. Where limited options for re-dispatch exist, sensitivities associated with the availability of those resources should be considered.
10. A stuck breaker means that for a gang-operated breaker, all three phases of the breaker have remained closed. For an independent pole operated (IPO) or an independent pole tripping (IPT) breaker, only one pole is assumed to remain closed. A stuck breaker results in Delayed Fault Clearing.
11. Excludes circuits that share a common structure (Planning event P7, Extreme event steady state 2a) or common Right-of-Way (Extreme event, steady state 2b) for 1 mile or less.
12. An objective of the planning process is to minimize the likelihood and magnitude of Non-Consequential Load Loss following planning events. In limited circumstances, Non-Consequential Load Loss may be needed throughout the planning horizon to ensure that BES performance requirements are met. However, when Non-Consequential Load Loss is utilized under footnote 12 within the Near-Term Transmission Planning Horizon to address BES performance requirements, such interruption is limited to circumstances where the Non-Consequential Load Loss meets the conditions shown in Attachment 1. In no case can the planned Non-Consequential Load Loss under footnote 12 exceed 75 MW for US registered entities. The amount of planned Non-Consequential Load Loss for a non-US Registered Entity should be implemented in a manner that is consistent with, or under the direction of, the applicable governmental authority or its agency in the non-US jurisdiction.
13. For purposes of this standard, non-redundant components of a Protection System to consider are as follows:
 - a. A single protective relay which responds to electrical quantities, without an alternative (which may or may not respond to electrical quantities) that provides comparable Normal Clearing times;
 - b. A single communications system associated with protective functions, necessary for correct operation of a communication-aided protection scheme required for Normal Clearing (an exception is a single communications system that is both monitored and reported at a Control Center);
 - c. A single station dc supply associated with protective functions required for Normal Clearing (an exception is a single station dc supply that is both monitored and reported at a Control Center for both low voltage and open circuit);
 - d. A single control circuitry (including auxiliary relays and lockout relays) associated with protective functions, from the dc supply through and including the trip coil(s) of the circuit breakers or other interrupting devices, required for Normal Clearing (the trip coil may be excluded if it is both monitored and reported at a Control Center).

- PJM will use the 2024 Series RTEP for formally identifying CAPs for P5 violations under the new standard.
 - Identification of violations began with the 2022 Series RTEP.
 - CAPs will be required for all valid faults.
 - Transmission Owners are also expected to evaluate and remediate all uncleared faults or those that have an undefinably long clearing time that may impact the BES.
 - CAPs will need to be developed, selected and approved by PJM by February 2025.
 - CAPs are anticipated to fall under the substation exclusion of FERC Order 1000.
 - Typical upgrades will include addressing non-redundancy and/or inclusion of monitoring & reporting where applicable within the substation.
 - CAPs required to be in-service for all valid violations on or before 7/1/2029 to align when the standard becomes fully enforceable.

SME/Presenter:
Stan Sliwa,
Stanley.Sliwa@pjm.com

TPL-001-5.1
P5 Corrective Action Plans (CAPs)



Member Hotline

(610) 666 – 8980

(866) 400 – 8980

custsvc@pjm.com

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1	03/05/2024	<ul style="list-style-type: none">• Original slides posted

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