

Revised Phase IIA Planning Standards, Measurements, and Compliance Templates

I.A. S3, M3 (Transmission Systems)

III.A. S3, M3 and M5 (Transmission Protection Systems)



North American Electric Reliability Council

NERC Board of Trustees

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Brief Description System performance following loss of two or more bulk system elements.

Category Assessments

Section I. System Adequacy and Security
A. Transmission Systems

Standard

S3. The interconnected transmission systems shall be planned, designed, and constructed such that the network can be operated to supply projected customer demands and projected firm (non-recallable reserved) transmission services, at all demand levels over the range of forecast system demands, under the conditions of the contingencies as defined in Category C of Table I (attached). The controlled interruption of customer demand, the planned removal of generators, or the curtailment of firm (non-recallable reserved) power transfers may be necessary to meet this standard.

Transmission system capability and configuration, reactive power resources, protection systems, and control devices shall be adequate to ensure the system performance prescribed in Table I.

The transmission systems also shall be capable of accommodating planned bulk electric equipment outages and continuing to operate within thermal, voltage, and stability limits under the conditions of the contingencies as defined in Category C of Table I (attached).

Measurement

M3. Entities responsible for the reliability of the interconnected transmission systems shall ensure that the system responses for Standard S3 are as defined in Category C (event(s) resulting in the loss of two or more elements) of Table I (attached) and summarized below:

- a. Line and equipment loadings shall be within applicable thermal rating limits.
- b. Voltage levels shall be maintained within applicable limits.
- c. Planned (controlled) interruption of customer demand or generation (as noted in Table I, footnote d) may occur, and contracted firm (non-recallable reserved) transfers may be curtailed.
- d. Stability of the network shall be maintained.
- e. Cascading outages shall not occur.

Assessment Requirements

Entities responsible for the reliability of the interconnected transmission systems (e.g., transmission owners, independent system operators (ISOs), regional transmission organizations (RTOs), or other groups responsible for planning the bulk electric systems) shall annually assess the performance of their systems in meeting Standard S3.

Valid assessments shall include the attributes listed below, and as more fully described in the following paragraphs:

1. Assessments shall be conducted for near-term (years one through five) and longer-term (years six through ten) planning horizons.
2. Assessments of the near-term planning horizon shall be supported by a current or past study that addresses the plan year being assessed. For assessments of the longer-term planning horizon, a current or past study that addresses the plan year being assessed shall only be required if marginal conditions that may have longer lead-time solutions have been identified in the near-term assessment.
3. Assessments shall address any planned upgrades needed to meet the performance requirements of Category C.

System performance assessments based on system simulation testing shall show that for system conditions where (See Table I Category C)

1. The initiating event results in the loss of two or more elements, or
2. Two separate events occur resulting in two or more elements out of service with time for manual system adjustments between events,

and with all projected firm transfers modeled, line and equipment loadings are within applicable thermal ratings, voltages are within applicable limits, and the systems are stable for selected demand levels over the range of forecast system demands. Planned outages of customer demand or generation (as noted in Table I, footnote d) may occur, and contracted firm (non-recallable reserved) transfers may be curtailed. This system performance shall be achieved for the described contingencies of Category C of Table I.

Assessments shall consider all contingencies applicable to Category C, but shall simulate and evaluate only those that would produce the more severe system results or impacts. The rationale for the contingencies selected for evaluation shall be available as supporting information and shall include an explanation of why the remaining simulations would produce less severe system results.

Assessments shall include the effects of existing and planned facilities, including reactive power resources to ensure that adequate reactive resources are available to meet the system performance as defined in Category C of Table I. Assessments shall also include the effects of existing and planned protection systems and control devices, including any backup or redundant protection systems, to ensure that protection systems and control devices are sufficient to meet the system performance as defined in Category C of Table I.

The systems must be capable of meeting Category C requirements while accommodating the planned (including maintenance) outage of any bulk electric equipment (including protection systems or their components) at those demand levels for which planned (including maintenance) outages are performed.

Assessments shall be conducted annually and shall cover critical system conditions and study years as deemed appropriate by the responsible entity. They shall also be conducted for near (years one through five) and longer-term (years six through ten) planning horizons. Simulation testing of the systems need not be conducted annually if changes to system conditions do not warrant such analyses. Simulation testing beyond the five-year horizon should be conducted as needed to address identified marginal conditions that may have longer lead-time solutions.

Corrective Plan Requirements

When system simulations indicate an inability of the systems to respond as prescribed in this Measurement (M3), responsible entities shall provide a written summary of their plans, including a schedule for implementation, to achieve the required system performance throughout the planning horizon as described above. Plan summaries shall discuss expected required in-service dates of facilities, and shall consider lead times necessary to implement plans. Identified system facilities for which sufficient lead times exist need not have detailed implementation plans, and shall be reviewed for continuing need in subsequent annual assessments.

Reporting Requirements

The documentation of results of these reliability assessments and corrective plans shall annually be provided to the entities' respective NERC Region(s), as required by the Region. Each Region, in turn, shall annually provide a summary (per Standard I.B. S1. M1) of its Regional reliability assessments to the NERC Planning Committee (or its successor).

Applicable to

Entities responsible for the reliability of interconnected transmission systems.

Items to be Measured

Assessments of system performance for events resulting in the loss of two or more bulk system elements.

Timeframe

Annually.

Levels of Non-Compliance (If non-compliant at more than one Level, the highest Level applies.)

Level 1

A valid assessment for the longer-term planning horizon is not available.

Level 2

Not applicable.

Level 3

A valid assessment for the near-term planning horizon is not available.

Level 4

Not applicable.

Compliance Monitoring Responsibility
Regions.

Reviewer Comments on Compliance Rating

NERC Planning Standards

I. System Adequacy and Security

A. Transmission Systems

Table I. Transmission Systems Standards — Normal and Contingency Conditions

Category	Contingencies	Elements Out of Service	System Limits or Impacts				
	Initiating Event(s) and Contingency Element(s)		Thermal Limits	Voltage Limits	System Stable	Loss of Demand or Curtailed Firm Transfers	Cascading ^c Outages
A - No Contingencies	All Facilities in Service	None	Applicable Rating ^a (A/R)	Applicable Rating ^a (A/R)	Yes	No	No
B - Event resulting in the loss of a single element.	Single Line Ground (SLG) or 3-Phase (3Ø) Fault, with Normal Clearing: 1. Generator 2. Transmission Circuit 3. Transformer Loss of an Element without a Fault.	Single Single Single Single	A/R A/R A/R A/R	A/R A/R A/R A/R	Yes Yes Yes Yes	No ^b No ^b No ^b No ^b	No No No No
	Single Pole Block, Normal Clearing ^f : 4. Single Pole (dc) Line	Single	A/R	A/R	Yes	No ^b	No
C - Event(s) resulting in the loss of two or more (multiple) elements.	SLG Fault, with Normal Clearing ^f : 1. Bus Section 2. Breaker (failure or internal fault)	Multiple Multiple	A/R A/R	A/R A/R	Yes Yes	Planned/Controlled ^d Planned/Controlled ^d	No No
	SLG or 3Ø Fault, with Normal Clearing ^f , Manual System Adjustments, followed by another SLG or 3Ø Fault, with Normal Clearing ^f : 3. Category B (B1, B2, B3, or B4) contingency, manual system adjustments, followed by another Category B (B1, B2, B3, or B4) contingency	Multiple	A/R	A/R	Yes	Planned/Controlled ^d	No
	Bipolar Block, with Normal Clearing ^f : 4. Bipolar (dc) Line	Multiple	A/R	A/R	Yes	Planned/Controlled ^d	No
	Fault (non 3Ø), with Normal Clearing ^f : 5. Any two circuits of a multiple circuit towerline ^g	Multiple	A/R	A/R	Yes	Planned/Controlled ^d	No
	SLG Fault, with Delayed Clearing ^f (stuck breaker or protection system failure): 6. Generator 7. Transmission Circuit 8. Transformer 9. Bus Section	Multiple Multiple	A/R A/R	A/R A/R	Yes Yes	Planned/Controlled ^d Planned/Controlled ^d	No No

Categories A and B - Approved by Planning Committee February 27, 2001, and NERC Board of Trustees June 12, 2001.

Category C - Approved by Planning Committee November 15, 2001, the Market Interface Committee January 10, 2002, and NERC Board of Trustees February 20, 2002.

Category D - Approved by Planning Committee September 27, 2001, and NERC Board of Trustees October 16, 2001.

NERC Planning Standards

I. System Adequacy and Security

A. Transmission Systems

<p>D^e - Extreme event resulting in two or more (multiple) elements removed or cascading out of service</p>	<p>3Ø Fault, with Delayed Clearing^f (stuck breaker or protection system failure):</p> <table border="0"> <tr> <td>1. Generator</td> <td>3. Transformer</td> </tr> <tr> <td>2. Transmission Circuit</td> <td>4. Bus Section</td> </tr> </table> <p>-----^f-----</p> <p>3Ø Fault, with Normal Clearing^f:</p> <p>5. Breaker (failure or internal fault)</p> <p>-----</p> <p>Other:</p> <ol style="list-style-type: none"> 6. Loss of towerline with three or more circuits 7. All transmission lines on a common right-of way 8. Loss of a substation (one voltage level plus transformers) 9. Loss of a switching station (one voltage level plus transformers) 10. Loss of all generating units at a station 11. Loss of a large load or major load center 12. Failure of a fully redundant special protection system (or remedial action scheme) to operate when required 13. Operation, partial operation, or misoperation of a fully redundant special protection system (or remedial action scheme) in response to an event or abnormal system condition for which it was not intended to operate 14. Impact of severe power swings or oscillations from disturbances in another Regional Council. 	1. Generator	3. Transformer	2. Transmission Circuit	4. Bus Section	<p>Evaluate for risks and consequences.</p> <ul style="list-style-type: none"> ▪ May involve substantial loss of customer demand and generation in a widespread area or areas. ▪ Portions or all of the interconnected systems may or may not achieve a new, stable operating point. ▪ Evaluation of these events may require joint studies with neighboring systems.
1. Generator	3. Transformer					
2. Transmission Circuit	4. Bus Section					

- a) Applicable rating (A/R) refers to the applicable normal and emergency facility thermal rating or system voltage limit as determined and consistently applied by the system or facility owner. Applicable ratings may include emergency ratings applicable for short durations as required to permit operating steps necessary to maintain system control. All ratings must be established consistent with applicable NERC Planning Standards addressing facility ratings.
- b) Planned or controlled interruption of electric supply to radial customers or some local network customers, connected to or supplied by the faulted element or by the affected area, may occur in certain areas without impacting the overall security of the interconnected transmission systems. To prepare for the next contingency, system adjustments are permitted, including curtailments of contracted firm (non-recallable reserved) electric power transfers.
- c) Cascading is the uncontrolled successive loss of system elements triggered by an incident at any location. Cascading results in widespread service interruption which cannot be restrained from sequentially spreading beyond an area predetermined by appropriate studies.
- d) Depending on system design and expected system impacts, the controlled interruption of electric supply to customers (load shedding), the planned removal from service of certain generators, and/or the curtailment of contracted firm (non-recallable reserved) electric power transfers may be necessary to maintain the overall security of the interconnected transmission systems.
- e) A number of extreme contingencies that are listed under Category D and judged to be critical by the transmission planning entity(ies) will be selected for evaluation. It is not expected that all possible facility outages under each listed contingency of Category D will be evaluated.
- f) Normal clearing is when the protection system operates as designed and the fault is cleared in the time normally expected with proper functioning of the installed protection systems. Delayed clearing of a fault is due to failure of any protection system component such as a relay, circuit breaker, or current transformer (CT), and not because of an intentional design delay.
- g) System assessments may exclude these events where multiple circuit towers are used over short distances (e.g., station entrance, river crossings) in accordance with Regional exemption criteria.

Categories A and B - Approved by Planning Committee February 27, 2001, and NERC Board of Trustees June 12, 2001.

Category C - Approved by Planning Committee November 15, 2001, the Market Interface Committee January 10, 2002, and NERC Board of Trustees February 20, 2002.

Category D - Approved by Planning Committee September 27, 2001, and NERC Board of Trustees October 16, 2001.

Brief Description Regional procedure on transmission protection misoperations.

Category Documentation

Section III. System Protection and Control
A. Transmission Protection Systems

Standard

S3. All transmission protection system misoperations shall be analyzed for cause and corrective action.

Measurement

M3. Each Region shall have a procedure for the monitoring, review, analysis, and correction of transmission protection system misoperations. The Regional procedure shall include the following elements:

- 1. Requirements for monitoring and analysis of all transmission protective device misoperations.**
- 2. Description of the data reporting requirements (periodicity and format) for those misoperations that adversely affect the reliability of the bulk electric systems as specified by the Region.**
- 3. Process for review, follow up, and documentation of corrective action plans for misoperations.**
- 4. Identification of the Regional group responsible for the procedure and the process for Regional approval of the procedure.**
- 5. Regional definition of misoperations.**

Documentation of the Regional procedure shall be maintained and provided to NERC on request (within 30 days).

Applicable to
Regions.

Items to be Measured

Procedure for monitoring, review, analysis, and correction of all transmission protection system misoperations.

Timeframe

On request (within 30 days).

Levels of Non-Compliance

Level 1

The Regional procedure does not address all the requirements as defined above in Measurement M3.

Level 2

Not applicable.

Level 3

Not applicable.

Level 4

The Regional procedure was not provided.

Compliance Monitoring Responsibility

NERC.

Reviewer Comments on Compliance Rating

Brief Description Analysis and reporting of transmission protection misoperations.

Category Documentation of implementation

Section III. System Protection and Control
A. Transmission Protection Systems

Standard

S3. All transmission protection system misoperations shall be analyzed for cause and corrective action.

Measurement

M5 Transmission protection system owners shall analyze all protection system misoperations and shall take corrective actions to avoid future misoperations.

Documentation of the misoperation analyses and corrective actions shall be provided to the affected Regions and NERC on request (within 30 days) according to the Regional procedures of Measurement III.A. S3, M3.

Applicable to

Transmission protection system owners.

Items to be Measured

Documentation of protection system misoperations, analyses, and corrective actions.

Timeframe

On request (within 30 days).

Levels of Non-Compliance

Level 1

Documentation of transmission protection system misoperations is complete according to Measurement III.A. S3, M3 but documentation of corrective actions taken for all identified misoperations is incomplete.

Level 2

Documentation of corrective actions taken for misoperations is complete but documentation of transmission protection system misoperations is incomplete according to Measurement III.A. S3, M3.

Level 3

Documentation of misoperations and corrective actions is incomplete.

Level 4

No documentation of misoperations or corrective actions was provided.

Compliance Monitoring Responsibility

Regions.

Reviewer Comments on Compliance Rating
