

Definitions of Terms Used in Standard

This section includes all newly defined or revised terms used in the proposed standard. Terms already defined in the NERC Reliability Standards Glossary of Terms or the MRO Reliability Standards Glossary of Terms are not repeated here. New or revised definitions listed below become approved when the proposed standard is approved. When the standard becomes effective, these defined terms will be removed from the individual standard and added to the Midwest Reliability Organization (“MRO”) Glossary. NERC and MRO defined terms are capitalized in the standard.

None

A. Introduction

- 1. **Title:** System Performance
- 2. **Number:** TPL-503-MRO-02
- 3. **Purpose:**
To ensure adequate interconnected transmission system performance in the MRO.
- 4. **Applicability**
 - 4.1. Planning Coordinator
 - 4.2. Transmission Planner
- 5. **Effective Date:**
1st day of the 1st quarter following all appropriate Regulatory Authority approvals, financial sanctions will become effective.

B. Requirements

R1. The Planning Coordinator and Transmission Planner shall each demonstrate through valid ~~assessment or~~ assessment(s) that its portion of the interconnected transmission system ~~is planned 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, meets the contingency conditions as defined in the MRO System Performance Table (Table 1), under all categories other than extreme events, which are in addition to the conditions defined in the most currently approved NERC TPL standard(s). [Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]~~

~~under the conditions defined in Category P1 of Table I of NERC TPL-001-01, the contingency conditions in Categories P2 and P3-4 of Table I of NERC TPL-001-01 and the contingency conditions as defined in the MRO System Performance Table (Table 1). To be valid, the Planning Coordinator and Transmission Planner annual assessment being conducted for near-term (years one through five) and longer-term (years six through ten) shall also: [Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]~~

~~**R1.1** — **R1.1** Be performed annually unless changes to system conditions do not warrant such analyses.~~

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~~**R1.2** Be conducted beyond the five-year horizon only as needed to address identified marginal conditions that may have longer lead-time solutions.~~

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~~**R1.3** Include current or past studies and/or simulation testing that:~~

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~~**R1.1.1** Demonstrate that System Performance meets the MRO System Performance Table for all categories, other than extreme events, Categories A through C in the same way that the Planning Coordinator and Transmission Planner demonstrates it meets the most currently approved NERC TPL standard(s) NERC TPL-001-01.~~

~~**R1.1.1.1** — Be performed annually unless changes to system conditions do not warrant such analyses.~~

~~R1.1.1.2~~ — Be conducted beyond the five year horizon only as needed to address identified marginal conditions that may have longer lead time solutions.

~~R1.13.2~~ Demonstrate that machine rotor angle oscillations are within damping limits as defined in the MRO System Performance Table.

~~R1.13.3~~ Be performed with the applicable facility thermal rating or system voltage limit for each disturbance category P3-4 disturbance that is the facility thermal rating or system voltage limit as defined by the system or facility owner in compliance with NERC FAC-008-01.

~~R1.13.4~~ For Normal Clearing of single line to ground (SLG) faults in Category P2 disturbances, include consideration of both single pole tripping if enabled with successful reclosing and single pole tripping if enabled with unsuccessful reclosing due to permanent SLG fault followed by Normal Clearing.

~~R1.3.5~~ Demonstrate that the System is capable of readjustment within the readjustment period so that facility loadings are within Normal Facility Ratings and facility voltage levels are within Normal system voltage limits following a disturbance. Permissible automatic and manual system readjustments are defined in the MRO System Performance Table (Table 1 notes 2 and 3).

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~~R1.24~~ Include any two (2) circuits of a multiple circuit tower line that are greater than one (1) mile in length. Demonstrate that any two circuits of a multiple circuit tower line excludes transmission circuits where multiple circuit towers are used over a cumulative distance of 1 mile or less in length. The Planning Coordinator and/or Transmission Planner may ask for a variance (refer to the MRO Standards Process Manual) to the multiple circuit tower line exclusion from the MRO on a case by case basis for short distances that are longer than one (1) mile (e.g., station entrance, river crossings).

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~~R1.3~~ Address any planned upgrades needed to meet the performance requirements of the MRO System Performance Table.

~~R1.45~~ Demonstrate by a current or past study and/or system simulation testing that Systems are capable of readjustment within the readjustment period required by NERC standards so that facility loadings are within Normal Facility Ratings and facility voltage levels are within Normal system voltage limits following a NERC Category P2-4 disturbance respectively. Permissible automatic and manual system readjustments are defined in the MRO System Performance Table (Table 1 notes 2 and 3).

~~R1.5~~ Include a safety margin when estimated model data is used to determine the actual or planned fault clearing time. The Planning Coordinator and/or the Transmission Planner shall document the basis for the safety margin.

Comment [LEB1]: Is this limited to Breakers? What evidence is needed?

R2. When studies or system simulations indicate an inability of the systems to respond as prescribed in R1, the Planning Coordinator and Transmission Planner shall each determine corrective plan(s) for its portion of the interconnected transmission system to

achieve the required system performance as described above throughout the planning horizon. *[Violation Risk Factor: Medium] [Time Horizon: Long-term Planning]*

- R3. The Planning Coordinator and Transmission Planner shall each document the results of these ~~Reliability-valid Assessments~~ and corrective plans for its portion of the interconnected transmission system and shall annually provide these assessments and plans to the MRO. *[Violation Risk Factor: Lower] [Time Horizon: Operational Planning/rations Assessment]*

C. Measures

- M1. The Planning Coordinator and Transmission Planner shall ~~each each provide~~ have evidence that it developed valid assessments in accordance with ~~R1 and R2~~.
- M2. The Planning Coordinator and Transmission Planner shall each ~~provide~~ have evidence that it determined corrective plan(s) for its portion of the interconnected transmission system in accordance with R2.
- M3. The Planning Coordinator and Transmission Planner shall each ~~provide~~ have evidence it reported documentation of results of its assessments and corrective plans annually to the MRO ~~in accordance with R3~~.

D. Compliance

1. Compliance Monitoring Process

- 1.1. **Compliance Monitoring Responsibility**
ERO delegated to Midwest Reliability Organization
- 1.2. **Compliance Monitoring Period and Reset Timeframe**
Annually
- 1.3. **Data Retention**
None specified.
- 1.4. **Additional Compliance Information**
None.

2. Violation Severity Levels

R #	Lower VSL	Moderate VSL	High VSL	Severe VSL
1	No safety margins were included when using estimated model data. Not applicable	Valid assessments and corrective plans for the longer-term planning horizon are not available.	Current or past studies and/or simulated studies were not included applicable	Valid assessments and corrective plans for the near-term planning horizon are not available.
2	Not applicable	Valid assessments and corrective plans for the longer-term planning horizon are not available.	Not applicable	Valid assessments and corrective plans for the near-term planning horizon are not available.

3	Evidence of reporting assessments and corrective plans was not available. Not applicable	Not applicable	Not applicable	Evidence of reporting assessments and corrective plans was not provided Not applicable
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Version History

Version	Date	Action	Change Tracking

Table 1: MRO SYSTEM PERFORMANCE TABLE¹

NERC Categories	Transient Voltage Deviation Limits	Rotor Angle Oscillation Damping Ratio Limits
P1 No Contingencies	Nothing in addition to NERC Requirements	
P2 Single Contingency (See Notes 2- and 6)	Minimum 0.70 p.u. at any bus (See Note 5)	Not to be less than 0.0081633 for disturbances with faults or less than 0.0167660 for line trips. (See Note 7)
P3-4 Multiple Contingency (See Notes 2, 3, and 6)	Minimum 0.70 p.u. at any bus (See Note 5)	Not to be less than 0.0081633 for disturbances with faults or less than 0.0167660 for line trips. (See Note 7)
P5 Extreme Event (See Notes 2, 3, and 4)	Nothing in addition to NERC Requirements	

Notes:

1. The MRO System Performance Table including the notes applies to the initial transient period following the contingency (up to 20 seconds) and the post-disturbance period (20 seconds to the end of the allowed readjustment period as described in R1.43.5).
2. The following summarizes the automatic and manual readjustments that are permissible for all ~~NERC Category P2 disturbances~~ **single contingencies**.
 - A. Generation adjustments - Reducing or increasing generation while keeping the units on-line or by bringing additional units on line. The amount of generation change is limited to that amount that can be accomplished within the allowed readjustment period. Due consideration shall be given to start up time and ramp rates of the units.
 - B. Capacitor and reactor switching - The number of capacitors and reactors which may be switched is limited to those which could be switched during the allowed readjustment period. This includes those capacitors and reactors that would be switched by automatic controls within the same period.
 - C. Adjustment of Load Tap Changers (LTCs) to the extent possible within the allowed readjustment period. This includes both LTCs which would automatically adjust and those under operator control which could be adjusted within the allowed readjustment period.
 - D. Adjustment of phase shifters to the extent possible within the allowed readjustment period.
 - E. An increase or decrease to the flow on HVDC facilities to the extent possible within the allowed readjustment period.
 - F. Generation rejection to the extent possible within the allowed readjustment period. Shall not exceed the normal operating reserve of the generation reserve sharing pool to which the MRO Member belongs or of the MRO Member itself if the MRO Member self-provides generation reserves.
 - G. Transmission reconfiguration - Automatic and operator initiated tripping of transmission lines or transformers to the extent possible within the allowed readjustment period.
 - H. Automatic or manual tripping of interruptible load or curtailment of or pre-determined redispatching of Firm Point-to-Point Transmission Service to the extent possible within the allowed readjustment period. Curtailment of Firm Transmission Service within the readjustment period is permitted only to prepare for the next contingency.

3. The following additional readjustment may be considered for all ~~NERC Category P3-4 contingencies~~multiple contingencies.
 - A. Automatic or manual tripping of firm Network or Native Load or curtailment of or predetermined redispatching of Firm Transmission Service to the extent possible within the allowed readjustment period.
4. The following additional readjustments may be considered for all ~~NERC Category P5 contingencies~~extreme events.
 - A. Planned and/or controlled islanding - Automatic underfrequency load shedding, as specified in NERC PRC-006-0, is permitted to arrest declining frequency and generation rejection is permitted to arrest increasing frequency in order to assure continued operation within the resulting islands.
 - B. Automatic undervoltage load shedding is permissible to arrest declining voltages and prevent widespread voltage collapse.
5. The voltage of 0.7 per unit is the point at which load dropping begins to occur due to motor contactors dropping out and induction motors stalling and also the point where sensitive equipment (e.g. power electronics) begin to drop out.
6. Apparent impedance transient swings into the inner two zones of distance relays are unacceptable for ~~NERC Category P2 disturbances~~single contingencies, unless documentation is provided showing the actual relays will not trip for the event. Apparent impedance transient swings into the inner two zones of distance relays are unacceptable for ~~NERC Category P3-4 disturbances~~multiple contingencies, unless documentation is provided that demonstrates that a relay trip will not result in instability (including voltage instability), uncontrolled separation, or cascading outages.
7. Damping is required during the initial transient period following the disturbance (up to 20 seconds). The machine rotor angle damping ratio is determined by appropriate modal analysis (~~for example~~e.g. Prony analysis). Alternatively, the Rotor Angle Oscillation Damping Factor or Successive Positive Peak Ratio (SPPR) can be calculated directly from the rotor angle, where the rotor angle response allows such direct calculation. For a disturbance with a fault, the SPPR must be less than 0.95 or the damping factor must be greater than 5%. For a disturbance without a fault, the SPPR must be less than 0.90 or the damping factor must be greater than 10%. (The Rotor Angle Oscillation Damping Ratio Limits were derived from the SPPR criteria.)