

A. Introduction

- 1. Title:** System Performance
- 2. Number:** MTPL-001-0
- 3. Purpose:**

To ensure adequate interconnected transmission system performance in the MRO.

4. Applicability

- 4.1.** Planning Authority
- 4.2.** Transmission Planner

- 5. (Proposed) Effective Date:** January 1, 2006.

B. Requirements

R1. The Planning Authority and Transmission Planner shall each demonstrate through a valid assessment 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, under the conditions defined in Category A of Table I of NERC TPL-001-000, the contingency conditions in Categories B and C of Table I of NERC TPL-002-000 and NERC TPL-003-000, and the contingency conditions as defined in the MRO System Performance Table (attached). To be valid, the Planning Authority and Transmission Planner assessment shall:

R1.1 Be performed annually.

R1.2 Be conducted for near-term (years one through five) of the planning horizon and longer-term (years six through ten) planning horizons.

R1.3 Be supported by a current or past study and/or system simulation testing associated with the categories, shown in the MRO System Performance Table. The specific elements selected (from each of the categories) for inclusion in these studies and simulations shall be acceptable to the Midwest Regional Organization. The studies and/or simulation testing shall:

R1.3.1 Be performed and evaluated only for those Category B and C contingencies that would produce the most severe system results or impacts. The rationale for the contingencies selected for evaluation shall be available as supporting information. An explanation of why the remaining simulations would produce less severe system results shall be available as supporting information.

R1.3.2 Cover critical system conditions and study years as deemed appropriate by the responsible entity

R1.3.3 Be conducted annually unless changes to system conditions do not warrant such analyses.

R1.3.4 Be conducted beyond the five-year horizon only as needed to address identified marginal conditions that may have longer lead-time solutions.

R1.3.5 Have all projected firm transfers modeled.

R1.3.6 Be performed and evaluated for selected demand levels over the range of forecast system demands.

- R1.3.7** Demonstrate that System Performance meets the MRO System Performance Table for Categories A through C.
- R1.3.8** Include existing and planned facilities.
- R1.3.9** Include Reactive Power resources to ensure that adequate reactive resources are available to meet System performance.
- R1.3.10** Demonstrate that adequate reactive power resources, with a balance between static and dynamic characteristics, are planned and distributed throughout its portion of the interconnected transmission system to ensure adequate system performance and prevent voltage collapse for Category B and C disturbances.
- R1.3.11** Include the effects of existing and planned protection systems, including any backup or redundant systems.
- R1.3.12** Include the effects of existing and planned control devices.
- R1.3.13** Include 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.
- R1.3.14** Demonstrate that out-of-step relay margins are within applicable limits, as defined in the MRO System Performance Table.
- R1.3.15** Demonstrate that machine rotor angle oscillations are within damping limits as defined in the MRO System Performance Table.
- R1.3.16** Demonstrate that peak demand levels including interruptible demands with buy- through provisions are supplied, except as noted in the MRO System Performance Table.
- R1.3.17** Demonstrate that off-peak demands with maximum Firm transfer levels (i.e. maintain Firm TTC) are supplied, except as noted in the MRO System Performance Table (Note 2H for Category B and Note 3B for Category C), at expected generation dispatch patterns.
- R1.3.18** Be performed with applicable ratings for Category C2, C6, C7, C8 and C9 disturbances that are those facility thermal ratings and system voltage limits, as defined by the facility owner assuming acceptable loss of life, that protect against instability (including voltage instability), uncontrolled separation, or cascading outages, consistent with transient voltage deviation limits, power oscillation damping ratio limits, and relay trip limits as provided in the MRO System Performance Table. In setting these Applicable Ratings, consideration must be given to the effects of high thermal loading, the effects of large steady-state voltage deviations, and the relay tripping values of all relay types.
- R1.3.19** Demonstrate that Normal Clearing of single line to ground (SLG) faults in Category B2 disturbances include 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.
- R1.4** Address any planned upgrades needed to meet the performance requirements of the MRO System Performance Table.

R1.5 Demonstrate that their systems are capable of Readjustment within 30 minutes such that Voltages are within Acceptable Voltage Levels and line and equipment loadings are within applicable ratings for all contingency conditions as defined in Category B and C of Table I of NERC TPL-002-0 and NERC TPL-003-0.

R2. When studies or system simulations indicate an inability to meet the performance requirements of the MRO System Table, the Planning Authority and Transmission Planner shall each provide a written summary of its plans to achieve the required system performance as described above throughout the planning horizon.

R3. The Planning Authority and Transmission Planner shall each document the results of these Reliability Assessments and corrective plans and shall annually provide these to the Midwest Reliability Organization.

C. Measures

M1. The Planning Authority and Transmission Planner shall have a valid assessment and corrective plans as specified in MTPL-001-0_R1 and MTPL-001-0_R2.

M2. The Planning Authority and Transmission Planner shall have evidence it reported documentation of results of its assessments and corrective plans per MTPL-001-0_R3.

D. Compliance

1. Compliance Monitoring Process

1.1. Compliance Monitoring Responsibility

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. Levels of Non-Compliance

2.1. Level 1: Not applicable.

2.2. Level 2: A valid assessment and corrective plan for the longer-term planning horizon is not available.

2.3. Level 3: Not applicable.

2.4. Level 4: A valid assessment and corrective plan for the shorter-term planning horizon is not available.

Version History

Version	Date	Action	Change Tracking

MRO SYSTEM PERFORMANCE TABLE¹

NERC and MRO Categories	Transient Voltage Deviation Limits (Up to 20 seconds)	Post Transient Voltage Deviation Limits (20 seconds to 30 minutes)	Post Transient Facility Seasonal Loading Limits (20 seconds to 30 minutes)	Rotor Angle Oscillation Damping Ratio Limits (Up to 20 seconds)	Out-of-Step Relay Trip Margin Limits (Up to 20 seconds)
A	Nothing in addition to NERC Requirements (See Notes 11 and 12)				Not to be less than 110%. (Canada – U.S. Interface) (See Note 10)
B (See Notes 2, 7, and 8)	Not to exceed 1.2 p.u. maximum or 0.7 p.u. minimum at any bus. (See Note 5)	Not to exceed 1.1 p.u. maximum or 0.9 p.u. minimum at any bus. (See Notes 5 and 6)	Not to exceed 110% for lines/station equipment and 125% for transformers (See Note 5)	Not to be less than 0.0081633 for disturbances with faults or less than 0.0167660 for line trips. (See Notes 5 and 9)	Not to be less than 25% transiently (Canada – U.S. Interface) (See Note 10)
C (See Notes 3, 7, and 8)	Not to exceed 1.2 p.u. maximum or 0.7 p.u. minimum at any bus. (See Note 5)	Not to exceed 1.1 p.u. maximum or 0.9 p.u. minimum at any bus. (See Notes 5 and 6)	Not to exceed 110% for lines/station equipment and 125% for transformers (See Note 5)	Not to be less than 0.0081633 for disturbances with faults or less than 0.0167660 for line trips. (See Notes 5 and 9)	Not to be less than 25% transiently (Canada – U.S. Interface) (See Note 10)
D (See Note 4)	Nothing in addition to NERC Requirements				

Notes:

1. *The MRO System Performance Table applies to the initial transient period following the contingency (up to 20 seconds) and the post-disturbance period (20 seconds to 30 minutes).*
2. *The following summarizes the automatic and manual readjustments that are permissible for all NERC/MRO Category B disturbances.*
 - A. *Generation Adjustments (Spinning and Non-Spinning Operating Reserve) - 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 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 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 (LTC's) to the extent possible within the Readjustment period. This includes both LTC's which would automatically adjust and those under operator control which could be adjusted within the Readjustment period.*
 - D. *Adjustment of phase shifters to the extent possible within the Readjustment period. Agreement must be obtained from the owner(s).*
 - E. *Adjustment of the amount of the flow the HVDC can be increased or decreased within the Readjustment period.*
 - F. *Generation Rejection – Generation may be rejected in one of two methods; tripping the generating unit or tripping generation supported tie lines. For either method, the amount of effective generation rejection within the Readjustment period shall not exceed 80% of the normal operating spinning reserve of the MRO System (one half of 1.5 times the largest unit). The following limits apply to generation rejection when tripping generating units:*
 - *Hydro - Up to one plant*
 - *Fossil - Up to two units at a plant*
 - G. *Transmission Reconfiguration - Automatic and operator initiated tripping of transmission lines or transformers within the Readjustment period.*
 - H. *Non-firm Load Shed – Automatic or manual tripping of Interruptible Load being supplied under MRO Service Schedule L or the pre-determined redispatching of Non-Firm Point-to-Point Transmission Service within the Readjustment period.*
3. *The following additional readjustments may be considered for all NERC/MRO Category C contingencies.*

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- A. *Generation Rejection – One Nuclear Unit may be rejected as long as the loss is less than 80% of the normal operating spinning reserve of the MRO System (one half of 1.5 times the largest unit).*
 - B. *Firm Load Shed – Automatic or manual tripping of firm Network or Native Load or the predetermined redispatching of firm Point-to-Point Transmission Service and Firm Transmission Network Service.*
4. *The following additional readjustments may be considered for all NERC/MRO Category D contingencies.*
 - A. *It is assumed that some planned and controlled islanding will occur for the most credible extreme disturbances. Automatic underfrequency load shedding as specified in NERC PRC-006-0 is expected to arrest declining frequency and generation rejection is expected 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 criteria listed in the MRO System Performance Table are the default limits. Specific buses, control areas or companies may have more or less restrictive criteria. Refer to the current MRO Members Reliability Criteria and Study Procedures Manual for a complete listing of specific reliability criteria.*
6. *If it can be demonstrated that post transient voltage deviations that are less than the values in the MRO System Performance Table will result in voltage instability, the system in which the disturbance originated and the affected system(s) should cooperate in mutually resolving the problem.*
7. *Apparent impedance transient swings into the inner two zones of distance relays are unacceptable for NERC/MRO Category B and C1, C3, C4, and C5 disturbances, 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/MRO Category C2, C6, C7, C8 and C9 disturbances, unless documentation is provided that demonstrates that a relay trip will not result in instability (including voltage instability), uncontrolled separation, or cascading outages.*
8. *A one-cycle safety margin shall be added to the actual or planned fault clearing time.*
9. *The machine rotor angle damping ratio is determined by modal analysis (e.g. Prony analysis or equivalent). 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%. Refer to the current MRO Members Reliability Criteria and Study Procedures Manual for a description of the calculation methodology.*
10. *The parameters listed in the MRO System Performance Table are the default minimum limits on MRO's Canada-U.S. interface. Refer to the MRO Members Reliability Criteria and*

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Study Procedures Manual for a complete listing of specific reliability criteria, detailed descriptions and margin definitions.

11. *Bulk transmission bus voltage levels between 0.95 P.U. and 1.05 P.U. of the nominal voltage base of the System, except as noted in the MRO Members Reliability Criteria and Study Procedures Manual.*
12. *Facility Loadings shall not exceed 100% of the Normal Rating (Rate A) for Lines or 100% of the Normal Rating for transformers.*