

A. Introduction

1. Title: Transmission Relay Loadability

2. Number: PRC-023-12

3. Purpose: Protective relay settings shall not limit transmission loadability; not interfere with system operators' ability to take remedial action to protect system reliability and; be set to reliably detect all fault conditions and protect the electrical network from these faults.

4. Applicability:

4.1. Functional Entities:

4.1.1 Transmission Owners with load-responsive phase protection systems as described in PRC-023 - Attachment A, applied to facilities defined ~~below~~ in 4.2.1 through 4.2.6.

4.1.2 Generator Owners with load-responsive phase protection systems as described in PRC-023- Attachment A, applied to facilities defined in 4.2.1 through 4.2.6.

4.1.3 Distribution Providers with load-responsive phase protection systems as described in PRC-023- Attachment A, applied according to facilities defined in 4.2.1 through 4.2.6, provided those facilities have bi-directional flow capabilities.

4.1.4 Planning Coordinators

4.1.4.2. Facilities:

~~4.1.4.2.1~~ 4.1.4.2.1 Transmission lines operated at 200 kV and above.

4.2.2 Transmission lines operated at 100 kV to 200 kV as designated by that the Planning Coordinator has determined are required to comply with this standard.

~~4.1.4.2.3~~ 4.1.4.2.3 Transmission lines operated below 100 kV that Regional Entities have identified as critical to facilities for the reliability purposes of the Bulk Electric System. Compliance Registry and the Planning Coordinator has determined are required to comply with this standard.

~~4.1.4.2.4~~ 4.1.4.2.4 Transformers with low voltage terminals connected at 200 kV and above.

~~4.1.4.2.5~~ 4.1.4.2.5 Transformers with low voltage terminals connected at 100 kV to 200 kV as designated by that the Planning Coordinator as critical has determined are required to the reliability of the Bulk Electric System comply with this standard.

~~4.2.~~ Generator Owners Transformers with load-responsive phase protection systems as described in Attachment A, applied to facilities defined in 4.1.1 through 4.1.4.

~~4.3.~~ Distribution Providers with load-responsive phase protection systems as described in Attachment A, applied according to facilities defined in 4.1.1 through 4.1.4., provided low voltage terminals connected below 100 kV that those facilities Regional Entities have bi-directional flow capabilities.

~~4.4.~~ Planning Coordinators.

FERC Order 733, ¶160: Apply an "add in" approach to sub-100 kV facilities.

FERC Order 733, ¶284: Remove the exceptions footnote from the "Effective Dates" section.

~~5. Effective Dates¹:~~

~~5.1. Requirement 1, Requirement 2:~~

~~5.1.1 For circuits described in 4.1.1 and 4.1.3 above (except for switch-on-to-fault schemes) — the beginning of the first calendar quarter following applicable regulatory approvals.~~

~~5.1.2 For circuits described in 4.1.2 and 4.1.4 above (including switch-on-to-fault schemes) — at the beginning of the first calendar quarter 39 months following applicable regulatory approvals.~~

~~5.1.34.2.6 Each Transmission Owner, Generator Owner, and Distribution Provider shall have 24 months after being notified by its identified as critical facilities for the purposes of the Compliance Registry and the Planning Coordinator pursuant to R3.3has determined are required to comply with R1 (including all sub-requirements) for each facility that is added to the Planning Coordinator's critical facilities list determined pursuant to R3.4this standard.~~

5. Effective Dates:

5.1. Requirement 3: 18 months following R1: the first day of the first calendar quarter after applicable regulatory approvals or in those jurisdictions where no regulatory approval is required, the first calendar quarter after Board of Trustees adoption, except as noted below.

5.1.1 For the addition to Requirement R1, criterion 10, to set transformer fault protection relays and transmission line relays on transmission lines terminated only with a transformer such that the protection settings do not expose the transformer to fault level and duration that exceeds its mechanical withstand capability, the first day of the first calendar quarter 12 months after applicable regulatory approvals or in those jurisdictions where no regulatory approval is required, the first day of the first calendar quarter 12 months after Board of Trustees adoption.

5.1.2 For supervisory elements as described in PRC-023 - Attachment A, section 1.6, the first day of the first calendar quarter 24 months after applicable regulatory approvals or in those jurisdictions where regulatory approval is not required, the first day of the first calendar quarter 24 months after Board of Trustees adoption.

5.2. Requirements R2 and R3: the first day of the first calendar quarter after applicable regulatory approvals or in those jurisdictions where no regulatory approval is required, the first day of the first calendar quarter after Board of Trustees adoption.

5.3. Requirements R4 and R5: the first day of the first calendar quarter six months after applicable regulatory approvals or in those jurisdictions where no regulatory approval is required the first day of the first calendar quarter six months after Board of Trustees adoption.

¹ Temporary Exceptions that have already been approved by the NERC Planning Committee via the NERC System Protection and Control Task Force prior to the approval of this standard shall not result in either findings of non-compliance or sanctions if all of the following apply: (1) the approved requests for Temporary Exceptions include a mitigation plan (including schedule) to come into full compliance, and (2) the non-conforming relay settings are mitigated according to the approved mitigation plan.

5.4. Requirement R6: the first day of the first calendar quarter 18 months after applicable regulatory approvals or in those jurisdictions where no regulatory approval is required the first day of the first calendar quarter 18 months after Board of Trustees adoption.

5.2.5.5. Requirement R7: the first day of the first calendar quarter after applicable regulatory approvals or in those jurisdictions where no regulatory approval is required, the first day of the first calendar quarter after Board of Trustees adoption.

B. Requirements

R1. Each Transmission Owner, Generator Owner, and Distribution Provider shall use any one of the following criteria (Requirement R1, criteria 1 through R1-13) for any specific circuit terminal to prevent its phase protective relay settings from limiting transmission system loadability while maintaining reliable protection of the ~~Bulk Electric System~~BES for all fault conditions. Each Transmission Owner, Generator Owner, and Distribution Provider shall evaluate relay loadability at 0.85 per unit voltage and a power factor angle of 30 degrees. *[Violation Risk Factor: High] [Mitigation Time Horizon: Long Term Planning].*

Criteria:

a.1. Set transmission line relays so they do not operate at or below 150% of the highest seasonal Facility Rating of a circuit, for the available defined loading duration nearest 4 hours (expressed in amperes).

b.2. Set transmission line relays so they do not operate at or below 115% of the highest seasonal 15-minute Facility Rating² of a circuit (expressed in amperes).

c.3. Set transmission line relays so they do not operate at or below 115% of the maximum theoretical power transfer capability (using a 90-degree angle between the sending-end and receiving-end voltages and either reactance or complex impedance) of the circuit (expressed in amperes) using one of the following to perform the power transfer calculation:

R1.1. An infinite source (zero source impedance) with a 1.00 per unit bus voltage at each end of the line.

R1.2. An impedance at each end of the line, which reflects the actual system source impedance with a 1.05 per unit voltage behind each source impedance.

d.4. Set transmission line relays on series compensated transmission lines so they do not operate at or below the maximum power transfer capability of the line, determined as the greater of:

- 115% of the highest emergency rating of the series capacitor.
- 115% of the maximum power transfer capability of the circuit (expressed in amperes), calculated in accordance with R1-Requirement R1, criterion 3, using the full line inductive reactance.

e.5. Set transmission line relays on weak source systems so they do not operate at or below 170% of the maximum end-of-line three-phase fault magnitude (expressed in amperes).

² When a 15-minute rating has been calculated and published for use in real-time operations, the 15-minute rating can be used to establish the loadability requirement for the protective relays.

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- ~~f.6.~~ Set transmission line relays applied on transmission lines connected to generation stations remote to load so they do not operate at or below 230% of the aggregated generation nameplate capability.
- ~~g.7.~~ Set transmission line relays applied at the load center terminal, remote from generation stations, so they do not operate at or below 115% of the maximum current flow from the load to the generation source under any system configuration.
- ~~h.8.~~ Set transmission line relays applied on the bulk system-end of transmission lines that serve load remote to the system so they do not operate at or below 115% of the maximum current flow from the system to the load under any system configuration.
- ~~i.9.~~ Set transmission line relays applied on the load-end of transmission lines that serve load remote to the bulk system so they do not operate at or below 115% of the maximum current flow from the ~~load~~ to the ~~system~~ under any system configuration.
- ~~j.10.~~ Set transformer fault protection relays and transmission line relays on transmission lines terminated only with a transformer ~~so that they~~ such that the protection settings do not expose the transformer to fault level and duration that exceeds its mechanical withstand capability and so that the relays do not operate at or below the greater of:
- ~~a.~~ 150% of the applicable maximum transformer nameplate rating (expressed in amperes), including the forced cooled ratings corresponding to all installed supplemental cooling equipment.
 - ~~b.~~ 115% of the highest operator established emergency transformer rating.
- ~~k.11.~~ For transformer overload protection relays that do not comply with ~~R1~~ the loadability component of Requirement R1, criterion 10 set the relays according to one of the following:
- Set the relays to allow the transformer to be operated at an overload level of at least 150% of the maximum applicable nameplate rating, or 115% of the highest operator established emergency transformer rating, whichever is greater. ~~The protection must allow this overload,~~ for at least 15 minutes to ~~allow~~ provide time for the operator to take controlled action to relieve the overload.
 - Install supervision for the relays using either a top oil or simulated winding hot spot temperature element. ~~The setting should be set~~ no less than 100° C for the top oil ~~or temperature or no less than~~ 140° C for the winding hot spot temperature³.
- ~~l.12.~~ When the desired transmission line capability is limited by the requirement to adequately protect the transmission line, set the transmission line distance relays to a maximum of 125% of the apparent impedance (at the impedance angle of the transmission line) subject to the following constraints:
- ~~l.a.~~ Set the maximum torque angle (MTA) to 90 degrees or the highest supported by the manufacturer.

FERC Order 733, ¶203: Modify sub-requirement R1.10 to verify equipment is capable of sustaining the anticipated overload associated with the fault.

³ IEEE standard C57.115, Table 3, specifies that transformers are to be designed to withstand a winding hot spot temperature of 180 degrees C, and cautions that bubble formation may occur above 140 degrees C.

2.b. Evaluate the relay loadability in amperes at the relay trip point at 0.85 per unit voltage and a power factor angle of 30 degrees.

3.c. Include a relay setting component of 87% of the current calculated in Requirement R1, criterion 12.2 in the Facility Rating determination for the circuit.

m.13. Where other situations present practical limitations on circuit capability, set the phase protection relays so they do not operate at or below 115% of such limitations.

R2. ~~The~~Each Transmission Owner, Generator Owner, ~~or~~and Distribution Provider shall verify that its out-of-step blocking elements allow tripping of phase protective relays for faults that occur during the loading conditions used to verify transmission line relay loadability per Requirement R1. [*Violation Risk Factor: High*] [*Time Horizon: Long Term Planning*]

FERC Order 733, ¶244: Include section 2 of Appendix A as an additional Requirement.

R2-R3. Each Transmission Owner, Generator Owner, and Distribution Provider that uses a circuit capability with the practical limitations described in ~~R1~~Requirement R1, criterion 6, R1.7, R1.8, R1.9, R1.12, or R1.13 shall use the calculated circuit capability as the Facility Rating of the circuit and shall obtain the agreement of the Planning Coordinator, Transmission Operator, and Reliability Coordinator with the calculated circuit capability. [*Violation Risk Factor: Medium*] [*Time Horizon: Long Term Planning*]

R4. ~~The Planning Coordinator shall determine which of the facilities (transmission lines~~Each Transmission Owner, Generator Owner, and Distribution Provider that chooses to use Requirement R1 criterion 2 as the basis for verifying transmission line relay loadability shall provide its Planning Coordinator, Transmission Operator, and Reliability Coordinator with a list of facilities associated with those transmission line relays at least once each calendar year, with no more than 15 months between reports [*Violation Risk Factor: Lower*] [*Time Horizon: Long Term Planning*]

FERC Order 733, ¶186: Modify R1.2 to require that TOs, GOs, and DPs give their TOPs a list of transmission facilities that implement R1.2.

R5. Each Transmission Owner, Generator Owner, and Distribution Provider that sets transmission line relays according to Requirement R1 criterion 12 shall provide a list of the facilities associated with those relays to its Regional Entity at least once each calendar year, with no more than 15 months between reports, to allow entities to know which facilities have protective relay settings that limit the facility's capability. [*Violation Risk Factor: Lower*] [*Time Horizon: Long Term Planning*]

FERC Order 733, ¶224: Make available for review to users, owners and operators of the Bulk-Power System, by request, a list of those facilities that have protective relays set pursuant sub-requirement R1.12 of anticipated overload.

R6. Each Planning Coordinator shall apply the criteria in Attachment B to an assessment conducted at least once each calendar year, with no more than 15 months between assessments, to determine which transmission Elements must comply with this standard. The Planning Coordinator shall: [*Violation Risk Factor: High*] [*Time Horizon: Long Term Planning*]

6.1 ~~Apply the criteria to transmission lines that are operated at 100 kV to 200 kV and transformers with low voltage terminals connected at 100 kV to 200 kV) in its Planning Coordinator Area are critical to the reliability of the Bulk Electric System to identify the facilities from 100 kV to 200 kV that must meet Requirement 1 to prevent potential cascade tripping that may occur when protective relay settings limit transmission loadability.~~ [*Violation Risk Factor: Medium*] [*Time Horizon: Long Term Planning*].

~~R2.1.~~ The Planning Coordinator shall have a process to determine the facilities that are critical to the reliability of the Bulk Electric System.

- ~~• This process shall consider input from adjoining Planning Coordinators and affected Reliability Coordinators.~~

~~6.2~~ The Planning Coordinator shall maintain a current Apply the criteria to transmission lines operated below 100 kV and transformers with low voltage terminal connections below 100 kV, if the Regional Entity has identified either of these Element types as critical facilities for the purposes of the Compliance Registry and they are in its Planning Coordinator Area.

~~6.3~~ Maintain a list of facilities determined according to the process described in ~~R3.1~~ Requirement R6.

~~6.4~~ The Planning Coordinator shall provide Include on the list the year studied for which criterion B4 in Attachment B first applies when a facility is added and only criterion B4 is applicable.

FERC Order 733, ¶237: Modify sub-requirement R3.3 to add the RE to list of entities that receive the critical facilities list.

~~6.5~~ Provide a list of facilities to ~~its~~ all Regional Entities, Reliability Coordinators, Transmission Owners, Generator Owners, and Distribution Providers within ~~30~~ its Planning Coordinator Area within 30 calendar days of the establishment of the initial list and within 30 calendar days of any changes to that list.

~~R3.R7.~~ Each Transmission Owner, Generator Owner, and Distribution Provider shall implement Requirement R1, Requirement R2, Requirement R3, Requirement R4, and Requirement R5 for each facility that is added to the list. Planning Coordinator's list of facilities that must comply with this standard pursuant to Requirement R6, Part 6.5 by the later of the first day of the second calendar quarter 24 months following notification by the Planning Coordinator of a facility's inclusion on such a list or the first day of the first calendar quarter of the year in which Attachment B criterion B4 first applies. [Violation Risk Factor: High] [Time Horizon: Long Term Planning]

C. Measures

~~M1.~~ The Transmission Owner, Generator Owner, and Distribution Provider shall ~~each~~ have evidence such as spreadsheets or summaries of calculations to show that each of its transmission relays ~~are~~ is set according to one of the criteria in ~~R1~~ Requirement R1, criterion 1 through 13 and shall have evidence such as coordination curves or summaries of calculations that show that relays set per criterion 10 do not expose the transformer to fault levels and durations beyond those indicated in the standard.

~~M1.M2.~~ The Transmission Owner, Generator Owner, and Distribution Provider shall have evidence such as spreadsheets or summaries of calculations to show that each of its out-of-step blocking elements allows tripping of phase protective relays for faults that occur during the loading conditions used to verify transmission line relay loadability per Requirement R1.13. ~~(R1 (R2))~~

~~M2.M3.~~ The Transmission Owner, Generator Owner, and Distribution Provider with transmission relays set according to ~~the criteria in~~ Requirement R1, criterion 6, R1.7, R1.8, R1.9, R1.12, or R.13 shall have evidence such as Facility Rating spreadsheets or Facility Rating database to show that they used the calculated circuit capability as the Facility Rating of the circuit and evidence such as dated correspondence that the resulting Facility Rating was agreed to by its associated Planning Coordinator, Transmission Operator, and Reliability Coordinator. ~~(R2R3)~~

M4. The Transmission Owner, Generator Owner, or Distribution Provider that sets transmission line relays according to Requirement R1, criterion 2 shall have evidence such as dated correspondence to show that they provided its Planning Coordinator~~shall have a documented process for the determination of,~~ Transmission Operator, and Reliability Coordinator with a list of facilities as described in R3, ~~associated with those transmission line relays.~~ (R4)

M5. The Transmission Owner, Generator Owner, or Distribution Provider that sets transmission line relays according to Requirement R1, criterion 12 shall have evidence such as dated correspondence that it provided a list of the facilities associated with those relays to its Regional Entity. (R5)

~~M3.M6.~~ The Planning Coordinator shall have a current list of such facilities and shall have evidence such as power flow results, calculation summaries, or study reports that it provided they used the list to criteria established within Attachment B to determine the appropriate facilities that must comply with this standard as described in Requirement R6. The Planning Coordinator shall have a dated list of such facilities and shall have evidence such as dated correspondence that it provided the list to the Regional Entities, Reliability Coordinators, Transmission Operators Owners, Generator Operators Owners, and Distribution Providers.~~(R3) within its Planning Coordinator Area.~~

M7. The Transmission Owner, Generator Owner, and Distribution Provider shall have evidence such as dated spreadsheets, summaries of calculations, and study reports, that it implemented the Requirements within the specified timeframe per Requirement R7.

D. Compliance

1. Compliance Monitoring Process

~~3.1.1.1.~~ Compliance Monitoring Responsibility

~~3.1.1~~ Compliance Enforcement Authority

~~3.2.~~ Compliance Monitoring Period and Reset Time Frame

~~One calendar year.~~

Regional Entity

~~3.3.1.2.~~ Data Retention

The Transmission Owner, Generator Owner, Distribution Provider and Planning Coordinator shall keep data or evidence to show compliance as identified below unless directed by its Compliance Enforcement Authority to retain specific evidence for a longer period of time as part of an investigation:

The Transmission Owner, Generator Owner, and Distribution Provider shall each retain documentation to demonstrate compliance with Requirements R1 through R5 and R7 for three calendar years.

The Planning Coordinator shall retain documentation of the most recent review process required in ~~R3~~R6. The Planning Coordinator shall retain the most recent list of facilities that are critical to the reliability of the electric system determined per ~~R3~~R6.

If a Transmission Owner, Generator Owner, Distribution Provider or Planning Coordinator is found non-compliant, it shall keep information related to the non-compliance until found compliant or for the time specified above, whichever is longer.

The Compliance Monitor shall ~~retain its compliance documentation for three years~~keep the last audit record and all requested and submitted subsequent audit records.

1.3. Compliance Monitoring and Assessment Processes

- Compliance Audit
- Self-Certification
- Spot Checking
- Compliance Violation Investigation
- Self-Reporting
- Complaint

3.4.1.4. Additional Compliance Information

~~The Transmission Owner, Generator Owner, Planning Coordinator, and Distribution Provider shall each demonstrate compliance through annual self-certification, or compliance audit (periodic, as part of targeted monitoring or initiated by complaint or event), as determined by the Compliance Enforcement Authority.~~

None.

4.2. Violation Severity Levels:

<u>R#Requirement</u>	Lower	Moderate	High	Severe
R1	<u>N/A</u>	Evidence that relay settings comply with criteria in R1.1 through 1.13 exists, but evidence is incomplete or incorrect for one or more of the subrequirements. <u>N/A</u>	<u>N/A</u>	<p>Relay settings do not comply with any of the sub requirements R1.1 through R1.13</p> <p>OR</p> <p>Evidence does not exist to support that relay settings comply with one of the criteria in subrequirements R1.1 through R1.13. The responsible entity did not use any one of the following criteria (Requirement R1 criterion 1 through 13) for any specific circuit terminal to prevent its phase protective relay settings from limiting transmission system loadability while maintaining reliable protection of the Bulk Electric System for all fault conditions.</p> <p>OR</p> <p>The responsible entity did not evaluate relay loadability at 0.85 per unit voltage and a power factor angle of 30 degrees.</p>
R2	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<p>The responsible entity failed to ensure that its out-of-step blocking elements allowed tripping of phase protective relays for faults that occur during the loading conditions used to verify transmission line relay loadability</p>

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				<u>per Requirement R1.</u>
<u>R2R3</u>	<u>Criteria described in R1.6, R1.7, R1.8, R1.9, R1.12, or R.13 was used but evidence does not exist that agreement was obtained in accordance with R2.N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>The responsible entity that uses a circuit capability with the practical limitations described in Requirement R1 criterion 6, 7, 8, 9, 12, or 13 did not use the calculated circuit capability as the Facility Rating of the circuit.</u> <u>OR</u> <u>The responsible entity did not obtain the agreement of the Planning Coordinator, Transmission Operator, and Reliability Coordinator with the calculated circuit capability.</u>
<u>R4</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>The responsible entity did not provide its Planning Coordinator, Transmission Operator, Regional Entity, and Reliability Coordinator with a list of facilities that have transmission line relays set according to the criteria established in Requirement R1 criterion 2 at least once each calendar year, with no more than 15 months between reports.</u>
<u>R5</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>The responsible entity did not provide its Regional Entity, with a list of facilities that have transmission line relays set according to the criteria established in Requirement R1 criterion 12 at least once each calendar year, with no more than 15 months between reports.</u>
<u>R3R6</u>	<u>N/A</u>	<u>Provided</u> The Planning Coordinator used the criteria	<u>Provided</u> The Planning Coordinator used the criteria	<u>Does not have a process in place to determine facilities</u>

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		<p><u>established within Attachment B to determine which transmission Elements, described in 6.1 and 6.2, in its Planning Coordinator area must comply with the standard and met parts 6.3 through 6.5, but more than 15 months and less than 24 months lapsed between assessments.</u></p> <p><u>OR</u></p> <p><u>The Planning Coordinator used the criteria established within Attachment B at least once each calendar year, with no more than 15 months between assessments to determine which transmission Elements, described in 6.1 and 6.2, in its Planning Coordinator area must comply with the standard and met 6.3 and 6.5 but failed to include the year studied for which criterion B4 in Attachment B first applies when a facility is added and only criterion B4 is applicable (part 6.4).</u></p> <p><u>OR</u></p> <p><u>The Planning Coordinator used the criteria established within Attachment B at least once each calendar year, with no more than 15 months between assessments to determine which transmission Elements, described in 6.1 and 6.2, in its Planning Coordinator area must comply with the standard and met 6.3 and 6.4 but provided the list of facilities</u> <u>critical to the reliability of the</u></p>	<p><u>established within Attachment B to determine which transmission Elements, described in 6.1 and 6.2, in its Planning Coordinator area must comply with the standard and met parts 6.3 through 6.5, but 24 months or more lapsed between assessments.</u></p> <p><u>OR</u></p> <p><u>The Planning Coordinator used the criteria established within Attachment B at least once each calendar year, with no more than 15 months between assessments to determine which transmission Elements, described in 6.1 and 6.2, in its Planning Coordinator area must comply with the standard and met 6.3 and 6.4 but provided the list of facilities</u> <u>critical to the reliability of the Bulk Electric System to the appropriate to the Reliability Coordinators, Transmission Owners, Generator Owners, and Distribution Providers</u> <u>between within its Planning Coordinator Area within 46 days and 60 days after list was established or updated.— (part 6.5).</u></p>	<p>that are critical to the reliability of the Bulk Electric System. <u>The Planning Coordinator failed to use the criteria established within Attachment B to determine which transmission Elements, described in 6.1 and 6.2, in its Planning Coordinator area must comply with the standard.</u></p> <p><u>OR</u></p> <p>Does not maintain a current list of facilities critical to the reliability of the Bulk Electric System; <u>OR</u></p> <p>Did not<u>The Planning Coordinator used the criteria established within Attachment B, at least once each calendar year, with no more than 15 months between assessments, to determine which transmission Elements, described in 6.1 and 6.2, in its Planning Coordinator area must comply with the standard but failed to meet parts 6.3, 6.4 and 6.5.</u></p> <p><u>OR</u></p> <p><u>The Planning Coordinator used the criteria established within Attachment B, at least once each calendar year, with no more than 15 months between assessments, to determine which transmission Elements in its Planning Coordinator area must comply with the standard but failed to apply the criteria to the Elements</u></p>
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		<p>Bulk Electric System to the appropriate to the Reliability Coordinators, Transmission Owners, Generator Owners, and Distribution Providers between 31 days within its Planning Coordinator Area within 31 days and 45 days after the list was established or updated. (part 6.5).</p>	<p>described in parts 6.1 and 6.2.</p> <p><u>OR</u></p> <p><u>The Planning Coordinator used the criteria established within Attachment B at least once each calendar year, with no more than 15 months between assessments to determine which transmission Elements, described in 6.1 and 6.2, in its Planning Coordinator area must comply with the standard and met 6.4 and 6.5 but failed to maintain the list of facilities determined according to the process described in Requirement R6 (part 6.3).</u></p> <p><u>OR</u></p> <p><u>The Planning Coordinator used the criteria established within Attachment B at least once each calendar year, with no more than 15 months between assessments to determine which transmission Elements, described in 6.1 and 6.2, in its Planning Coordinator area must comply with the standard and met 6.3 and 6.4 but failed to provide the list of facilities critical to the reliability of the Bulk Electric System to the appropriate to the Reliability Coordinators, Transmission Owners, Generator Owners, and Distribution Providers, <u>within its Planning Coordinator Area</u> or provided the list more than 60 days after the list was established or updated. (part 6.5).</u></p>
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<u>R7</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>The Transmission Owner, Generator Owner, or Distribution Provider failed to implement Requirement R1, Requirement R2, Requirement R3, Requirement R4, and Requirement R5 for each facility that is added to the Planning Coordinator's list of facilities that must comply with this standard pursuant to Requirement R6, Part 6.5 by the later of the first day of the second calendar quarter after 24 months following notification by the Planning Coordinator of a facility's inclusion on such a list by the Planning Coordinator or the first day of the first calendar quarter of the year in which Attachment B criterion B4 first applies.</u>
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E. **Regional Differences**

None

F. **Supplemental Technical Reference Document**

1.3. The following document is an explanatory supplement to the standard. It provides the technical rationale underlying the requirements in this standard. The reference document contains methodology examples for illustration purposes it does not preclude other technically comparable methodologies

“Determination and Application of Practical Relaying Loadability Ratings,” Version 1.0, January 9, 2007, prepared by the System Protection and Control Task Force of the NERC Planning Committee, available at: <http://www.nerc.com/~filez/reports.html>.

Version History

Version	Date	Action	Change Tracking
1	February 12, 2008	Approved by Board of Trustees	New
1	March 19, 2008	Corrected typo in last sentence of Severe VSL for Requirement 3 — “then” should be “than.”	Errata
1	March 18, 2010	Approved by FERC	
<u>2</u>	<u>November 1, 2010</u>	<u>Revised to address directives from Order 733</u>	

PRC-023 — Attachment A

~~R1.1.~~ This standard includes any protective functions which could trip with or without time delay, on load current, including but not limited to:

~~4.1.1.1.~~ Phase distance.

~~4.2.1.2.~~ Out-of-step tripping.

~~4.3.1.3.~~ Switch-on-to-fault.

~~4.4.1.4.~~ Overcurrent relays.

~~4.5.1.5.~~ Communications aided protection schemes including but not limited to:

~~4.5.1.5.1~~ Permissive overreach transfer trip (POTT).

~~4.5.2.1.5.2~~ Permissive under-reach transfer trip (PUTT).

~~4.5.3.1.5.3~~ Directional comparison blocking (DCB).

~~4.5.4.1.5.4~~ Directional comparison unblocking (DCUB).

~~5.~~ This standard includes out of step blocking schemes which shall be evaluated to ensure that they do not block trip for faults during the loading conditions defined within the requirements.

~~1.6.~~ Supervisory elements associated with current-based, communication-assisted schemes where the scheme is capable of tripping for loss of communications.

FERC Order 733, ¶264: Revise section 1 of Attachment A to include supervising relay elements.

~~R2.2.~~ The following protection systems are excluded from requirements of this standard:

~~5.1.2.1.~~ Relay elements that are only enabled when other relays or associated systems fail. For example:

~~1.3.1.~~ Overcurrent elements that are only enabled during loss of potential conditions.

~~1.3.2.~~ Elements that are only enabled during a loss of communications: except as noted in section 1.6

~~5.2.2.2.~~ Protection systems intended for the detection of ground fault conditions.

~~5.3.2.3.~~ Protection systems intended for protection during stable power swings.

~~5.4.2.4.~~ Generator protection relays that are susceptible to load.

~~5.5.2.5.~~ Relay elements used only for Special Protection Systems applied and approved in accordance with NERC Reliability Standards PRC-012 through PRC-017 or their successors.

~~5.6.2.6.~~ Protection systems that are designed only to respond in time periods which allow ~~operators~~ 15 minutes or greater to respond to overload conditions.

~~5.7.2.7.~~ Thermal emulation relays which are used in conjunction with dynamic Facility Ratings.

~~5.8.2.8.~~ Relay elements associated with ~~DCdc~~ lines.

~~5.9.2.9.~~ Relay elements associated with ~~DCdc~~ converter transformers.

PRC-023 — Attachment B

Criteria

Review each applicable circuit against the criteria in this Attachment to determine the facilities that must comply with the standard.

Applicable circuits include:

- Transmission lines operated at 100 kV to 200 kV and transformers with low voltage terminals connected at 100 kV to 200 kV
- Transmission lines operated below 100 kV and transformers with low voltage terminals connected below 100 kV that Regional Entities have identified as critical facilities for the purposes of the Compliance Registry

If any of the following criteria apply to a circuit, the circuit must comply with the standard.

- B1. Each circuit that is a monitored Element of a flowgate in the Eastern Interconnection, a major transfer path within the Western Interconnection as defined by the Regional Entity, or a comparable monitored Element in the Texas Interconnection or Québec Interconnection, that has been included to address long-term reliability concerns, as confirmed by the applicable Planning Coordinator.
- B2. Each circuit that is a monitored Element of an IROL where the IROL was determined in the long-term planning horizon.
- B3. Each circuit that forms a path (as agreed to by the plant owner and the Transmission Entity) to supply off-site power to nuclear plants.
- B4. Each circuit identified through the following power flow analysis:
- Simulate double contingency combinations selected by engineering judgment in TPL-003 Category C3, but without manual system adjustments in between (reflects a situation where a System Operator may not have time between the two contingencies to make appropriate system adjustments).
 - For circuits operated between 100 kV and 200 kV evaluate the post-contingency loading against the Facility Rating assigned for that circuit and used in the power flow case by the Planning Coordinator.
 - When more than one Facility Rating for that circuit is available in the power flow case, the threshold for selection will be based on the Facility Rating for the loading duration nearest four hours.
 - The threshold for selection as a circuit that must comply with the standard will vary based on the loading duration assumed in the development of the Facility Rating.
 - a. If the Facility Rating is based on a loading duration of up to and including four hours, the circuit must comply with the standard if the loading exceeds 115% of the Facility Rating.

FERC Order 733, ¶69: Specify the test that PC's must use to determine whether sub-200 kV facility is critical to reliability of the BES

Standard PRC-023-12— Transmission Relay Loadability

- b. If the Facility Rating is based on a loading duration greater than four and up to and including eight hours, the circuit must comply with the standard if the loading exceeds 120% of the Facility Rating.
- c. If the Facility Rating is based on a loading duration of greater than eight hours, the circuit must comply with the standard if the loading exceeds 130% of the Facility Rating.
- Radial circuits serving only load are excluded.
- B5. Each circuit that the Planning Coordinator may include based on other technical studies or assessments.