

# Stakeholder Comment and AESO Reply Matrix

2011-09-28

## AESO AUTHORITATIVE DOCUMENT PROCESS

### Alberta Reliability Standard – PRC-023-AB-1 Transmission Relay Loadability



#### COMPARISON BETWEEN NERC PRC-023-1 AND ALBERTA PRC-023-AB-1 Transmission Relay Loadability

NERC PRC-023-1	Draft 2 Alberta PRC-023-AB-1 from previous consultation <sup>1</sup>	Reason for Differences	Stakeholder Comments (Insert comments here)	AESO Replies
<p><b>Purpose</b></p> <p>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.</p>	<p><b>Purpose</b></p> <p>The purpose of this reliability standard is to ensure the protective relay settings do not limit transmission loadability, do not interfere with system operators ability to take remedial action to protect system reliability and, are set to reliably detect all fault conditions and protect the electrical network from these faults.</p>	<p>Clarified the purpose to align with the content of the reliability standard.</p>		
<p><b>Applicability</b></p> <p>4.1. Transmission Owners with load-responsive phase protection systems as described in Attachment A, applied to facilities defined below:</p> <p>4.1.1 Transmission lines operated at 200 kV and above.</p> <p>4.1.2 Transmission lines operated at 100 kV to 200 kV as designated by the Planning Coordinator as critical to the</p>	<p><b>Applicability</b></p> <p>This <b>reliability standard</b> applies to:</p> <ul style="list-style-type: none"> <li>• TFOs with load-responsive phase protection systems, as described in Attachment A, and with any of the facilities defined below:                             <ul style="list-style-type: none"> <li>○ transmission lines operated at 200 kV and above.</li> <li>○ transmission lines operated at 100 kV to 200 kV as identified by</li> </ul> </li> </ul>	<p><input type="checkbox"/> New  <input checked="" type="checkbox"/> Amended  <input type="checkbox"/> Deleted</p> <p>Amended to allow a reasonable amount of time for Alberta entities to implement this Alberta Reliability Standard.</p>	<p><b>AltaLink Management Ltd</b></p> <p><input type="checkbox"/> Support  <input checked="" type="checkbox"/> Support with language suggestions  <input type="checkbox"/> Oppose</p> <p>1. The specific transmission lines and transformers between 100 kV and 200 kV need to be identified either as an appendix in this standard or include a reference to another document listing these facilities.</p>	<p>1. The AESO agrees with AltaLink, and accordingly, will publish a link on the AESO website to the list referred to in Alberta requirement R3.2 of propose PRC-023-AB-1 Draft 2.1 when such list is</p>

<sup>1</sup> This version of the reliability standard was consulted on in July 2010.

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<p>reliability of the Bulk Electric System.</p> <p><b>4.1.3</b> Transformers with low voltage terminals connected at 200 kV and above.</p> <p><b>4.1.4</b> Transformers with low voltage terminals connected at 100 kV to 200 kV as designated by the Planning Coordinator as critical to the reliability of the Bulk Electric System.</p> <p><b>4.2.</b> Generator Owners with load-responsive phase protection systems as described in Attachment A, applied to facilities defined in 4.1.1 through 4.1.4.</p> <p><b>4.3.</b> 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 that those facilities have bi-directional flow capabilities.</p> <p><b>4.4.</b> Planning Coordinators</p>	<p>the ISO as critical to the reliability of the BES as required in requirement R3.</p> <ul style="list-style-type: none"> <li>○ transformers with low voltage terminals connected at 200 kV and above.</li> <li>○ transformers with low voltage terminals connected at 100 kV to 200 kV as designated by the ISO as critical to the reliability of the BES.</li> </ul> <ul style="list-style-type: none"> <li>• ISO</li> </ul>		<p><b>Nexen Inc</b></p> <p><input type="checkbox"/> Support</p> <p><input type="checkbox"/> Support with language suggestions</p> <p><input checked="" type="checkbox"/> Oppose</p> <p><b>2.</b> Nexen has concerns regarding “transmission lines operated at 100 kV to 200 kV as identified by the ISO as critical to the reliability of the BES as required in requirement R3” and “transformers with low voltage terminals connected at 100 kV to 200 kV as designated by the ISO as critical to the reliability of the BES”. As noted in comments provided in PRC-007, if the AESO intends to reference a document / lists not outlined in the standard or utilize terms which are crucial to the standard (i.e. “which affects the reliability of the AIES electric system or the bulk electric system”) that information must be included in the stakeholder consultation process for that standard. Without all the important information available market participants cannot adequately evaluate the impact that standard has on their operations, nor does it lend itself to</p>	<p>developed in the future. The procedures for amending the list referred to in Alberta requirement R3.2 will be included in such list at that time.</p> <p><b>2.</b> Please see AESO Reply 1 above.</p>

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			<p>a full robust consultation which would be beneficial to the AESO and the industry.</p> <p>3. Nexen also submits the AESO's rationale for a variance from the NERC standard (i.e. "GFO removed as all transmission facilities in Alberta are managed by a registered TFO.") reaffirms the need to review the definitions associated with the functional entity registration model. If the AESO has encountered circumstances where the current functional entity definitions creates concerns, Nexen submits the AESO should undertake a comprehensive review of the current functional entity definitions to ensure consistency and efficiency of the process and in turn does not broaden a market participants compliance obligations beyond what is reasonable.</p> <p><b>Suncor Energy</b>  <input type="checkbox"/> Support  <input type="checkbox"/> Support with language suggestions  <input checked="" type="checkbox"/> Oppose</p> <p>4. Suncor is recommending that as new assets are identified as applicable to this Standard, that the Standard be updated periodically</p>	<p>3. The revised Alberta reliability standards functional model and criteria for registration is posted on the AESO website, please refer to the announcement letter and the revised document at:</p> <p><a href="#">Functional Model Changes and Applicability</a></p> <p><a href="#">Functional Model and Criteria for Registration</a></p> <p>The AESO recently consulted on a number of defined terms, such as "legal owner" and "operator", for application in Alberta reliability standards to ensure definitional consistency as part of the Transition of Authoritative Document ("TOAD") project.</p> <p>4. The AESO disagrees with Suncor that the list be included with the standard. Please see AESO Reply 1 above.</p>

**COMPARISON BETWEEN NERC PRC-023-1 AND ALBERTA PRC-023-AB-1**

**Transmission Relay Loadability**

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			<p>with a communication to the market participants on the ARS Working Groups and Committee. This will ensure that binding obligations are clearly identified within the Standard, which is subject to non-compliance penalties.</p> <p>5. Suncor is also recommending that a new entity classification be added to this and other standards – a market participant / registered entity who owns a transmission asset (TAO) -- to avoid the incorrect use of Transmission Facility Owner. As it stands, some Standards are not applicable to TAOs that are otherwise applicable to TFOs which adds additional and unreasonable administrative burden to non TFOs.</p> <p><b>TransCanada</b>  <input type="checkbox"/> Support  <input type="checkbox"/> Support with language suggestions  <input checked="" type="checkbox"/> Oppose</p> <p>6. As TransCanada has discussed with the AESO, there is considerable uncertainty and confusion in the industry with respect the TFO classification or the recently introduced “<b>legal owner</b> of a <b>transmission facility</b>”. Until this is resolved TransCanada</p>	<p>5. Please see AESO Reply 3 above.</p> <p>6. Please see AESO Reply 3 above.</p>

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			cannot support the development or approval of any further reliability standards that are applicable to TFOs or <b>legal owners</b> of a <b>transmission facility</b> . TransCanada recommends that the AESO initiate a process engaging all stakeholders to resolve this issue	
<p><b>Effective Date</b></p> <p><b>5.1.</b> Requirement 1, Requirement 2:  <b>5.1.1</b> 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.  <b>5.1.2</b> 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.  <b>5.1.3</b> Each Transmission Owner, Generator Owner, and Distribution Provider shall have 24 months after being notified by its Planning Coordinator pursuant to R3.3 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 R3.1.</p> <p><b>5.2.</b> Requirement 3: 18 months following applicable regulatory</p>	<p><b>Effective Date</b></p> <p>For requirements R1 and R2 for transmission lines operated at 200kV and above and transformers with low voltage terminals connected at 200kV and above, except for switch-on-to-fault schemes, the beginning of the first calendar quarter following ninety (90) days after the date of approval by the Commission.</p> <p>For requirements R1 and R2 for transmission lines operated at 100 kV to 200 kV as identified by the ISO as critical to the reliability of the BES and transformers with low voltage terminals connected at 100 kV to 200 kV as designated by the ISO as critical to the reliability of the BES, including switch-on-to-fault schemes, on the first day of the month after the 39<sup>th</sup> full month following the date of approval by the Commission.</p>	<input type="checkbox"/> New <input checked="" type="checkbox"/> Amended <input type="checkbox"/> Deleted  Amended to allow a reasonable amount of time for Alberta entities to implement this Alberta Reliability Standard.	<p><b>AltaLink Management Ltd</b></p> <input checked="" type="checkbox"/> Support <input type="checkbox"/> Support with language suggestions <input type="checkbox"/> Oppose  <p><b>Suncor Energy</b></p> <input type="checkbox"/> Support <input type="checkbox"/> Support with language suggestions <input checked="" type="checkbox"/> Oppose, as written  <p>7. Concerning R1 and R2, Suncor is recommending that additional time be granted to registered entities after the AUC has approved this Standard to ensure that existing relay settings meet these requirements. Suncor needs at least 2 years to meet this Standard to do the following:</p> <ul style="list-style-type: none"> <li>▪ Do an analysis of applicable relays;</li> <li>▪ Conduct engineering assessments;</li> </ul>	<p>7. The AESO has proposed staggered effective dates for proposed PRC-023-AB-1 Draft 2.1 to allow sufficient time for market participants to prepare for and implement proposed PRC-023-AB-1 Draft 2.1.</p>

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approvals.	Requirement R3, the first day of the month after the 18 <sup>th</sup> full month following the date of approval by the Commission.		<ul style="list-style-type: none"> <li>▪ Schedule outage periods to minimize impacts on production;</li> <li>▪ Complete risk assessments to understand impacts on production;</li> <li>▪ to coordinate relay settings with regional entities and entities within Suncors' ISDs; and, to identify and gain management approval to make the changes required to meet the approved Standard.</li> </ul> <p><b>TransAlta</b></p> <p><input type="checkbox"/> Support</p> <p><input checked="" type="checkbox"/> Support with language suggestions</p> <p><input type="checkbox"/> Oppose</p> <p><b>8.</b> TransAlta proposes that the effective dates be simpler&gt; R1 &amp; R2 (200kV and above) – 180 days after approval by the Commission.</p> <p>TransAlta also proposes a defined effective date of 180 days (vs. the variable date as suggested by the AESO) as registered entities may need to review their relay setting on the transmission lines and if they don't comply with this standard, an engineering study and possible outage to implement settings may be required. This could require the full 180 days.</p>	<p><b>8.</b> Please see AESO Reply 7 above.</p>

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			R1 & R2 (100kV to 200kV) – 39 months after date of approval by the Commission.	
<p><b>R1.</b> Each Transmission Owner, Generator Owner, and Distribution Provider shall use any one of the following criteria (R1.1 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 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].</p> <p><b>R1.1.</b> 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).</p> <p><b>R1.2.</b> Set transmission line relays so they do not operate at or below 115% of the highest seasonal 15-minute Facility Rating<sup>2</sup> of a circuit (expressed in amperes).  <sup>2</sup> When a 15-minute rating has been calculated and published for use in real-</p>	<p><b>R1</b> Each TFO must use one of the criteria set out in requirements R1.1 through R1.13, inclusive, for each of its specific circuit terminals to prevent its phase protective relay settings from limiting transmission system loadability while maintaining reliable protection of the BES for all fault conditions; and evaluate relay loadability at 0.85 per unit voltage and a power factor angle of 30 degrees.</p> <p><b>R1.1.</b> 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 to four hours, expressed in amperes;</p> <p><b>R1.2.</b> Set transmission line relays so they do not operate at or below 115% of the highest seasonal 15-minute facility rating of a transmission line expressed in amperes;</p>	<p><input type="checkbox"/> New  <input checked="" type="checkbox"/> Amended  <input type="checkbox"/> Deleted</p> <p>Amended for clarity and consistency and to identify the responsible entities in Alberta.</p> <p>Sub-requirements R1.3.1 and R1.3.2 amended to show their inter-relationship..</p>	<p><b>AltaLink Management Ltd</b>  <input type="checkbox"/> Support  <input checked="" type="checkbox"/> Support with language suggestions  <input type="checkbox"/> Oppose</p> <p><b>9.</b> AltaLink’s support is based on the understanding that each circuit element needs to satisfy ONLY ONE of the thirteen requirements (i.e. R1.1 to R1.13).   AltaLink will oppose any other interpretation/requirement due to the complexity and uncertainty this would introduce.</p> <p><b>10.</b> Regarding R1.5, the term of “weak source systems” needs to be better defined to ensure consistent application of the requirement.</p> <p><b>11.</b> Regarding R1.6, AltaLink believes this requirement is not practical or reasonable for major generation</p>	<p><b>9.</b> The AESO agrees with AltaLink's comment. As specified in Alberta requirement R1 of proposed PRC-023-AB-1 Draft 2.1, each legal owner of a transmission facility, legal owner of a generating unit and legal owner of an aggregated generating facility “must use one of the criteria set out in requirements R1.1 through R1.13...”</p> <p><b>10.</b> The AESO is of the opinion that good electrical industry practice is to be used by the legal owner of a transmission facility, legal owner of a generating unit and legal owner of an aggregated generating facility in meeting Alberta requirement R1.5 of proposed PRC-023-AB-1 Draft 2.1.</p> <p><b>11.</b> Upon confirmation that the generating facility is remote to load, the application of the 230%</p>

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<p>time operations, the 15-minute rating can be used to establish the loadability requirement for the protective relays</p> <p><b>R1.3.</b> 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:</p> <p><b>R1.3.1.</b> An infinite source (zero source impedance) with a 1.00 per unit bus voltage at each end of the line.</p> <p><b>R1.3.2.</b> 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.</p> <p><b>R1.4.</b> 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:</p> <ul style="list-style-type: none"> <li>- 115% of the highest emergency rating of the series capacitor.</li> <li>- 115% of the maximum power transfer capability of the circuit (expressed in amperes), calculated in accordance with R1.3, using the full line inductive reactance.</li> </ul>	<p><b>R1.3.</b> 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 transmission line expressed in amperes, using one of the following to perform the power transfer calculation:</p> <p><b>R1.3.1.</b> an infinite source (zero source impedance) with a 1.00 per unit bus voltage at each end of the transmission line; or</p> <p><b>R1.3.2.</b> an impedance at each end of the transmission line, which reflects the actual system source impedance with a 1.05 per unit voltage behind each source impedance.</p> <p><b>R1.4.</b> Set transmission line relays on series compensated transmission lines so they do not operate at or below the maximum power transfer capability of the transmission line, determined as the greater of:</p> <ul style="list-style-type: none"> <li>■ 115% of the highest emergency rating of the series capacitor, or</li> <li>■ 115% of the maximum power transfer capability of the transmission line (expressed in amperes), calculated in accordance with requirement R1.3,</li> </ul>		<p>plant with multiple transmission lines connected.</p> <p>For example, will any one of the 240 kV transmission lines from Sundance Generation Plant be expected to carry 230% of the total generation of this plant (i.e. 230% of 2320 MW = 5336 MW)?</p> <p>Altalink would suggest further wording clarification is required within R1.6.</p> <p><b>Nexen Inc</b></p> <p><input type="checkbox"/> Support</p> <p><input type="checkbox"/> Support with language suggestions</p> <p><input checked="" type="checkbox"/> Oppose</p> <p><b>12.</b> R1.4: It is Nexen’s understanding that NERC R1.10 states 150% of the applicable maximum transformer nameplate rating while the AESO states 115%. Can the AESO please outline its rationale for the variance between the NERC requirement and AESO’s proposal?</p> <p><b>Suncor Energy</b></p> <p><input type="checkbox"/> Support</p> <p><input checked="" type="checkbox"/> Support with language suggestions / clarification</p> <p><input type="checkbox"/> Oppose</p>	<p>of the total generating capacity would be shared amongst the various lines connected to the generating facility and not to any one of the 240 kV lines.</p> <p><b>12.</b> Thank you for advising the AESO of the conflict. The typographical error made in Alberta requirement R1.10 of the previously proposed PRC-023-AB-1 Draft 2 has been corrected in proposed PRC-023-AB-1 Draft 2.1 to reflect “150%” of the applicable maximum transformer nameplate rating which was incorrectly stated as “115%”.</p>

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<p><b>R1.5.</b> 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).</p> <p><b>R1.6.</b> 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</p> <p><b>R1.7.</b> 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.</p> <p><b>R1.8.</b> 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.</p> <p><b>R1.9.</b> Set transmission line relays applied on the load-end of transmission</p>	<p>using the full transmission line inductive reactance;</p> <p><b>R1.5.</b> 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;</p> <p><b>R1.6.</b> Set transmission line relays applied on transmission lines connected to generating facilities remote to load so they do not operate at or below 230% of the aggregated generating unit(s) nameplate capability;</p> <p><b>R1.7.</b> Set transmission line relays applied at the load center terminal, remote from generating facilities, 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;</p> <p><b>R1.8.</b> 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;</p> <p><b>R1.9.</b> Set transmission line relays applied on the load-end of transmission lines that serve load remote to the BES</p>		<p><b>13.</b> What does R1.1 mean? Please clarify.</p> <p><b>TransAlta</b>  <input type="checkbox"/> Support  <input type="checkbox"/> Support with language suggestions  <input checked="" type="checkbox"/> Oppose</p> <p><b>14.</b> R1.4: TransAlta is concerned that NERC R1.10 states 150% of the applicable maximum transformer nameplate rating, but AESO states 115%. The AESO has not provided a reason for difference and we believe 150% is more appropriate.</p> <p><b>15.</b> R1.11 – TransAlta is concerned that the footnotes in R1.2 and R1.11 have been removed from the AESO standard. These footnotes provide clarity to proper industry standards. The AESO needs to comment on why these were removed.</p> <p><b>16.</b> R1.3 - TransAlta is concerned that NERC uses the term 'circuit' while</p>	<p><b>13.</b> The AESO is of the opinion that the Alberta requirement R1.1 is clear and does not need further explanation. The AESO suggests that Suncor's protection engineering staff be consulted for further clarification.</p> <p><b>14.</b> Please see AESO Reply 12 above.</p> <p><b>15.</b> Please note that all facility ratings are submitted to the AESO per existing practices. There is no "published for use in real-time operations" list as mentioned in footnote 2.</p> <p>Footnote 3 is general information and is not part of the binding requirement. It will be considered for inclusion in a future AESO Information Document.</p> <p><b>16.</b> The AESO agrees with TransAlta and Alberta requirement R1.3 has</p>

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<p>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.</p> <p><b>R1.10.</b> Set transformer fault protection relays and transmission line relays on transmission lines terminated only with a transformer so that they do not operate at or below the greater of:            - 150% of the applicable maximum transformer nameplate rating (expressed in amperes), including the forced cooled ratings corresponding to all installed supplemental cooling equipment.            - 115% of the highest operator established emergency transformer rating.</p> <p><b>R1.11.</b> For transformer overload protection relays that do not comply with R1.10 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 for the operator to take controlled action to relieve the overload. Install supervision for the relays using</p>	<p>so they do not operate at or below 115% of the maximum current flow from the load to the system under any system configuration;</p> <p><b>R1.10.</b> Set transformer fault protection relays and transmission line relays on transmission lines terminated only with a transformer so that they do not operate at or below the greater of:            ■ 115% of the applicable maximum transformer nameplate rating expressed in amperes, including the forced cooled ratings corresponding to all installed supplemental cooling equipment; or            ■ 115% of the highest operator established emergency transformer rating;</p> <p><b>R1.11.</b> For transformer overload protection relays that do not comply with requirement R1.10 set the relays according to 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 emergency transformer rating, whichever is greater. The protection must allow this overload for at least 15 minutes to allow for the system 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 no less than</p>		<p>AESO uses the term 'line'. AESO should be consistent with NERC, otherwise clarify what the difference is.</p>	<p>been amended proposed PRC-023-AB-1 Draft 2.1 to address this inconsistency.</p>

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NERC PRC-023-1	Draft 2 Alberta PRC-023-AB-1 from previous consultation <sup>1</sup>	Reason for Differences	Stakeholder Comments (Insert comments here)	AESO Replies
<p>either a top oil or simulated winding hot spot temperature element. The setting should be no less than 100° C for the top oil or 140° C for the winding hot spot temperature<sup>3</sup>.</p> <p><sup>3</sup> 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.</p> <p><b>R1.12.</b> 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:</p> <p><b>R1.12.1.</b> Set the maximum torque angle (MTA) to 90 degrees or the highest supported by the manufacturer.</p> <p><b>R1.12.2.</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.</p> <p><b>R1.12.3.</b> Include a relay setting component of 87% of the current calculated in R1.12.2 in the Facility Rating determination for the circuit.</p> <p><b>R1.13.</b> Where other situations present practical limitations on circuit capability,</p>	<p>100°C for the top oil or 140°C for the winding hot spot temperature;</p> <p><b>R1.12.</b> 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:</p> <p><b>R1.12.1.</b> Set the maximum torque angle (MTA) to 90 degrees or the highest setting supported by the manufacturer.</p> <p><b>R1.12.2.</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; and</p> <p><b>R1.12.3.</b> Include a relay setting component of 87% of the current calculated in requirement <b>R1.12.2.</b> in the facility rating determination for the circuit.</p> <p><b>R1.13.</b> 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.</p>			

COMPARISON BETWEEN NERC PRC-023-1 AND ALBERTA PRC-023-AB-1				
Transmission Relay Loadability				
NERC PRC-023-1	Draft 2 Alberta PRC-023-AB-1 from previous consultation <sup>1</sup>	Reason for Differences	Stakeholder Comments (Insert comments here)	AESO Replies
set the phase protection relays so they do not operate at or below 115% of such limitations				
<b>R2.</b> The Transmission Owner, Generator Owner, or Distribution Provider that uses a circuit capability with the practical limitations described in R1.6, 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]	<b>R2.</b> A TFO that uses a circuit capability with the practical limitations described in requirements R1.6, R1.7, R1.8, R1.9, R1.12, or R1.13 must use the calculated circuit capability as the facility rating of the circuit and must obtain the agreement of the ISO to use the calculated circuit capability.	<input type="checkbox"/> New <input checked="" type="checkbox"/> Amended <input type="checkbox"/> Deleted  Amended to identify requirements of the responsible entities in Alberta and for clarity and consistency.  <b>Alberta Variance<sup>2</sup>:</b> Reliability Coordinator is not included in Alberta requirement R2. NERC requirement R2 states that agreement shall be obtained from the Planning Coordinator, Transmission Operator, and Reliability Coordinator. The ISO is the authority from which TFOs and GFOs will obtain agreement for the calculated circuit capability and the ISO will consult with the WECC Reliability Coordinator at its discretion.	<b>AltaLink Management Ltd</b> <input type="checkbox"/> Support <input checked="" type="checkbox"/> Support with language suggestions <input type="checkbox"/> Oppose  <b>17.</b> Regarding R1.6, AltaLink believes this requirement is not practical or reasonable for major generation plant with multiple transmission lines connected. For example, will any one of the 240 kV transmission lines from Sundance Generation Plant be expected to carry 230% of the total generation of this plant (i.e. 230% of 2320 MW = 5336 MW)?  Altalink would suggest further wording clarification is required within R1.6.	<b>17.</b> Please see AESO Reply 11 above.
<b>R3.</b> The Planning Coordinator shall determine which of the facilities (transmission lines 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	<b>R3.</b> The ISO must identify which transmission lines operated at 100 kV to 200 kV and transformers with low voltage terminals connected at 100 kV to 200 kV are critical to the reliability of the BES in order to prevent potential cascade tripping that may occur when protective relay settings limit transmission loadability. In order to	<input type="checkbox"/> New <input checked="" type="checkbox"/> Amended <input type="checkbox"/> Deleted  Amended to identify requirements of the responsible entities in Alberta and for clarity and consistency.  Deleted redundant requirement from	<b>AltaLink Management Ltd</b> <input checked="" type="checkbox"/> Support <input type="checkbox"/> Support with language suggestions <input type="checkbox"/> Oppose  <b>Suncor Energy</b>	

<sup>2</sup> An Alberta variance is a change from the US Reliability Standard that the AESO has determined is material.

COMPARISON BETWEEN NERC PRC-023-1 AND ALBERTA PRC-023-AB-1				
Transmission Relay Loadability				
NERC PRC-023-1	Draft 2 Alberta PRC-023-AB-1 from previous consultation <sup>1</sup>	Reason for Differences	Stakeholder Comments (Insert comments here)	AESO Replies
<p>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]</p> <p><b>R3.1.</b> The Planning Coordinator shall have a process to determine the facilities that are critical to the reliability of the Bulk Electric System.</p> <p><b>R3.2.</b> The Planning Coordinator shall maintain a current list of facilities determined according to the process described in R3.1.</p> <p><b>R3.3.</b> The Planning Coordinator shall provide a list of facilities to its Reliability Coordinators, Transmission Owners, Generator Owners, and Distribution Providers within 30 days of the establishment of the initial list and within 30 days of any changes to the list.</p>	<p>carry out this requirement, the ISO must do the following:</p> <p><b>R3.1</b> The ISO must have a process to determine the facilities that are critical to the reliability of the BES and must consider input from adjoining planning coordinators and affected reliability coordinators.</p> <p><b>R3.2</b> The ISO must maintain a current list of facilities determined according to the process specified in requirement R3.1 .</p> <p><b>R3.3</b> The ISO must provide a list of facilities maintained pursuant to requirement R3.2 to each TFO within 30 days of the establishment of the initial list and within 30 days of any changes to the list.</p>	<p>requirement R3 that states, “These identified facilities must meet requirement R1”.</p>	<p><input type="checkbox"/> Support  <input checked="" type="checkbox"/> Support with language suggestions  <input type="checkbox"/> Oppose</p> <p><b>18.</b> Suncor is recommending that when the AESO defines a draft process to determine facilities that are critical to the reliability of the BES, that the AESO communicates and gains input from market participants on the ARS Working Groups and Committee on the approach being employed. This includes updating this Standard when the identified process is defined and/or revised, as the Standard is binding and is subject to non-compliance penalties.</p>	<p><b>18.</b> The AESO will consider whether stakeholder input is required when implementing Alberta requirement R3.1. Please see AESO Reply 1 above.</p>
	<p><b>R4</b> TFOs must comply with requirement R1 for all new facilities added to the ISO’s list of facilities within 2 years of receipt from the ISO as contemplated in requirement R3.3.</p>	<p><input checked="" type="checkbox"/> New  <input type="checkbox"/> Amended  <input type="checkbox"/> Deleted</p> <p>Added to address timelines for TFOs to meet requirement R1 for new facilities added to the ISO list. This is consistent</p>	<p><b>AltaLink Management Ltd</b>  <input checked="" type="checkbox"/> Support  <input type="checkbox"/> Support with language suggestions  <input type="checkbox"/> Oppose</p> <p><b>Suncor Energy</b></p>	

COMPARISON BETWEEN NERC PRC-023-1 AND ALBERTA PRC-023-AB-1				
Transmission Relay Loadability				
NERC PRC-023-1	Draft 2 Alberta PRC-023-AB-1 from previous consultation <sup>1</sup>	Reason for Differences	Stakeholder Comments (Insert comments here)	AESO Replies
		with the timelines in the effective date section of the NERC reliability standard.	<input type="checkbox"/> Support <input type="checkbox"/> Support with language suggestions <input checked="" type="checkbox"/> Oppose  <b>19.</b> Suncor is recommending that the same time period of time (2 years) be granted to market participants to change existing relays after this Standard is approved by the AUC	<b>19.</b> Please see AESO Reply 7 above.
<b>M1.</b> The Transmission Owner, Generator Owner, and Distribution Provider shall each have evidence to show that each of its transmission relays are set according to one of the criteria in R1.1 through R1.13. (R1)	<b>MR1.</b> The TFO must have evidence to show that each of its transmission relays is set according to one of the criteria in requirements R1.1 through R1.13.  Records of actual settings are within acceptable tolerances of the applicable criteria in requirements R1.1 through R1.13.	<input type="checkbox"/> New <input checked="" type="checkbox"/> Amended <input type="checkbox"/> Deleted  Amended to align with requirement R1	<b>AltaLink Management Ltd</b> <input checked="" type="checkbox"/> Support <input type="checkbox"/> Support with language suggestions <input type="checkbox"/> Oppose  <b>Suncor Energy</b> <input checked="" type="checkbox"/> Support <input type="checkbox"/> Support with language suggestions <input type="checkbox"/> Oppose	
<b>M2.</b> The Transmission Owner, Generator Owner, and Distribution Provider with transmission relays set according to the criteria in R1.6, R1.7, R1.8, R1.9, R1.12, or R.13 shall have evidence that the resulting Facility Rating was agreed to by its associated Planning Coordinator, Transmission Operator, and Reliability Coordinator. (R2)	<b>MR2</b> The TFO with transmission relays set according to the criteria in requirements R1.6, R1.7, R1.8, R1.9, R1.12, or R.13 must have evidence that the ISO agreed to the resulting facility rating.	<input type="checkbox"/> New <input checked="" type="checkbox"/> Amended <input type="checkbox"/> Deleted  Amended to align with requirement R2.	<b>AltaLink Management Ltd</b> <input checked="" type="checkbox"/> Support <input type="checkbox"/> Support with language suggestions <input type="checkbox"/> Oppose  <b>Suncor Energy</b> <input checked="" type="checkbox"/> Support <input type="checkbox"/> Support with language suggestions <input type="checkbox"/> Oppose	

COMPARISON BETWEEN NERC PRC-023-1 AND ALBERTA PRC-023-AB-1				
Transmission Relay Loadability				
NERC PRC-023-1	Draft 2 Alberta PRC-023-AB-1 from previous consultation <sup>1</sup>	Reason for Differences	Stakeholder Comments (Insert comments here)	AESO Replies
<p><b>M3.</b> The Planning Coordinator shall have a documented process for the determination of facilities as described in R3. The Planning Coordinator shall have a current list of such facilities and shall have evidence that it provided the list to the appropriate Reliability Coordinators, Transmission Operators, Generator Operators, and Distribution Providers. (R3)</p>	<p><b>MR3.1</b> Written process exists which includes input from adjoining planning coordinators and affected reliability coordinators and is of sufficient detail to meet requirements specified in requirement R3.1.  <b>MR3.2</b> List is complete and up to date as specified in requirement R3.2.  <b>MR3.3</b> Confirmation that the ISO provided the list as specified in requirement R3.3.</p>	<input type="checkbox"/> New <input checked="" type="checkbox"/> Amended <input type="checkbox"/> Deleted  Amended to align with requirement R3.	<p><b>AltaLink Management Ltd</b>  <input checked="" type="checkbox"/> Support  <input type="checkbox"/> Support with language suggestions  <input type="checkbox"/> Oppose</p>	
			<p><b>Suncor Energy</b>  <input type="checkbox"/> Support  <input type="checkbox"/> Support with language suggestions  <input checked="" type="checkbox"/> Oppose</p> <p><b>20.</b> MR3.1 The term “sufficient detail” needs to be defined and does not provide clarity to the registered entity to assess compliance.</p>	
	<p><b>MR4</b> Evidence exists that TFOs complied with requirement R1 for new facilities added to the ISO’s list of facilities as specified in requirement R4.</p>	<input checked="" type="checkbox"/> New <input type="checkbox"/> Amended <input type="checkbox"/> Deleted  Added to align with requirement R4.	<p><b>AltaLink Management Ltd</b>  <input checked="" type="checkbox"/> Support  <input type="checkbox"/> Support with language suggestions  <input type="checkbox"/> Oppose</p>	
			<p><b>Suncor Energy</b>  <input checked="" type="checkbox"/> Support  <input type="checkbox"/> Support with language suggestions  <input type="checkbox"/> Oppose</p>	
<p><b>Compliance</b>            To view the compliance section D of the NERC reliability standard follow this link: <a href="http://www.nerc.com/files/BAL-002-0.pdf">http://www.nerc.com/files/BAL-002-0.pdf</a></p>		<p>The Alberta reliability standards do not contain a compliance section. Compliance with all Alberta reliability standards is completed in accordance with the Alberta Reliability Standards Compliance Monitoring Program, available on the AESO website at:</p>		

COMPARISON BETWEEN NERC PRC-023-1 AND ALBERTA PRC-023-AB-1				
Transmission Relay Loadability				
NERC PRC-023-1	Draft 2 Alberta PRC-023-AB-1 from previous consultation <sup>1</sup>	Reason for Differences	Stakeholder Comments (Insert comments here)	AESO Replies
		<a href="http://www.aeso.ca/loadsettlement/17189.html">http://www.aeso.ca/loadsettlement/17189.html</a>		
<b>Regional Differences</b> None identified.	<b>Regional Differences</b> None identified.	Not applicable in Alberta		

Appendix 1				
NERC PRC-023-1	Draft 2 Alberta PRC-023-AB-1 From previous consultation	Reason for Differences	Stakeholder Comments (Insert comments here)	AESO Replies
<p>1. This reliability standard includes any protective functions which could trip with or without time delay, on load current, including but not limited to:</p> <ul style="list-style-type: none"> <li>1.1. Phase distance.</li> <li>1.2. Out-of-step tripping.</li> <li>1.3. Switch-on-to-fault.</li> <li>1.4. Overcurrent relays.</li> <li>1.5. Communications aided protection schemes including but not limited to: <ul style="list-style-type: none"> <li>1.5.1 Permissive overreach transfer trip (POTT).</li> <li>1.5.2 Permissive under-reach transfer trip (PUTT).</li> <li>1.5.3 Directional comparison blocking (DCB).</li> <li>1.5.4 Directional comparison unblocking (DCUB).</li> </ul> </li> </ul> <p>2. This reliability standard includes out-of-step blocking schemes which must be evaluated to ensure that they do not block trip for faults during the loading conditions defined within this reliability</p>	<p>1. This reliability standard includes any protective functions which could trip with or without time delay, on load current, including but not limited to:</p> <ul style="list-style-type: none"> <li>1.1. Phase distance.</li> <li>1.2. Out-of-step tripping.</li> <li>1.3. Switch-on-to-fault.</li> <li>1.4. Overcurrent relays.</li> <li>1.5. Communications aided protection schemes including but not limited to: <ul style="list-style-type: none"> <li>1.5.1 Permissive overreach transfer trip (POTT).</li> <li>1.5.2 Permissive under-reach transfer trip (PUTT).</li> <li>1.5.3 Directional comparison blocking (DCB).</li> <li>1.5.4 Directional comparison unblocking (DCUB).</li> </ul> </li> </ul> <p>2. This reliability standard includes out-of-step blocking schemes which must be evaluated to ensure that they do not block trip for faults during the loading conditions defined within this reliability</p>	<input type="checkbox"/> New <input checked="" type="checkbox"/> Amended <input type="checkbox"/> Deleted  Amended 3.5 to align with Alberta Reliability Standards.	<b>AltaLink Management Ltd</b> <input checked="" type="checkbox"/> Support <input type="checkbox"/> Support with language suggestions  <input type="checkbox"/> Oppose  <b>Nexen Inc</b> <input type="checkbox"/> Support <input type="checkbox"/> Support with language suggestions <input checked="" type="checkbox"/> Oppose  <b>21.</b> In Section 3.5 below, it references standards PRC-015-AB-0, PRC-016-AB-0 and PRC-017-AB-0. It is Nexen's understanding that these standards have not been	<b>21.</b> The AESO agrees with Nexen's comment. The referenced standards have been removed from proposed PRC-023-AB-1 Draft 2.1.

Appendix 1				
NERC PRC-023-1	Draft 2 Alberta PRC-023-AB-1 From previous consultation	Reason for Differences	Stakeholder Comments (Insert comments here)	AESO Replies
<p>standard's requirements.</p> <p><b>3.</b> The following protection systems are excluded from the requirements of this reliability standard:</p> <p><b>3.1.</b> Relay elements that are only enabled when other relays or associated systems fail. For example:</p> <ul style="list-style-type: none"> <li>• Overcurrent elements that are only enabled during loss of potential conditions; or</li> <li>• Elements that are only enabled during a loss of communications.</li> </ul> <p><b>3.2.</b> Protection systems intended for the detection of ground fault conditions.</p> <p><b>3.3.</b> Protection systems intended for protection during stable power swings.</p> <p><b>3.4.</b> Generating unit protection relays that are susceptible to load.</p> <p><b>3.5.</b> Relay elements used only for Special Protection Systems applied and approved in accordance with NERC Reliability Standards PRC-012 through PRC-017.</p> <p><b>3.6.</b> Protection systems that are designed only to respond in time periods which allow operators 15 minutes or greater to respond to overload conditions.</p> <p><b>3.7.</b> Thermal emulation relays which are used in conjunction with dynamic Facility Ratings.</p> <p><b>3.8.</b> Relay elements associated with DC lines.</p>	<p>standard's requirements.</p> <p><b>3.</b> The following protection systems are excluded from the requirements of this reliability standard:</p> <p><b>3.1.</b> Relay elements that are only enabled when other relays or associated systems fail. For example:</p> <ul style="list-style-type: none"> <li>• Overcurrent elements that are only enabled during loss of potential conditions; or</li> <li>• Elements that are only enabled during a loss of communications.</li> </ul> <p><b>3.2.</b> Protection systems intended for the detection of ground fault conditions.</p> <p><b>3.3.</b> Protection systems intended for protection during stable power swings.</p> <p><b>3.4.</b> Generating unit protection relays that are susceptible to load.</p> <p><b>3.5.</b> Relay elements used only for RASs applied and approved in accordance with reliability standards PRC-015-AB-0, PRC-016-AB-0 and PRC-017-AB-0.</p> <p><b>3.6.</b> Protection systems that are designed only to respond in time periods which allow operators 15 minutes or greater to respond to overload conditions.</p> <p><b>3.7.</b> Thermal emulation relays which are used in conjunction with dynamic Facility Ratings.</p> <p><b>3.8.</b> Relay elements associated with DC lines.</p>		<p>approved or in effect. Nexen submits until the three referenced standards have been approved and are effective, this standard cannot be implemented. Only when the three standards have been approved can this standard come into force.</p> <p><b>Suncor Energy</b></p> <p><input type="checkbox"/> Support</p> <p><input type="checkbox"/> Support with language suggestions</p> <p><input checked="" type="checkbox"/> Oppose</p> <p><b>22.</b> PRC-015-AB-0, PRC-016-AB-0 and PRC-017-AB-0 have not been approved by the AUC. Please remove these standards until they are approved.</p> <p><b>TransAlta</b></p> <p><input type="checkbox"/> Support</p> <p><input type="checkbox"/> Support with language suggestions</p> <p><input checked="" type="checkbox"/> Oppose</p> <p><b>23.</b> Section 3.5 of Attachment A references standards PRC-015-AB-0, PRC-016-AB-0 and PRC-017-AB-0, all of which are not approved and effective in Alberta. This standard should not be approved until such time as the 3referenced standards in the attachment are approved.</p>	<p><b>22.</b> Please see AESO Reply 21 above.</p> <p><b>23.</b> Please see AESO Reply 21 above.</p>

<b>Appendix 1</b>				
<b>NERC PRC-023-1</b>	<b>Draft 2 Alberta PRC-023-AB-1 From previous consultation</b>	<b>Reason for Differences</b>	<b>Stakeholder Comments (Insert comments here)</b>	<b>AESO Replies</b>
<b>3.9. Relay elements associated with DC converter transformers</b>	<b>3.9.</b> Relay elements associated with DC converter transformers.			
<b>Regional Differences</b> None identified.	<b>Regional Differences</b> None identified.			

New Definitions	Stakeholder Comments (Insert comments here)	AESO Replies
<p><b>(a) New</b></p> <p>“planning coordinator” means the responsible entity that coordinates and integrates transmission facility and service plans, resource plans, and protection systems.</p>	<p><b>AltaLink Management Ltd</b></p> <p>X <input checked="" type="checkbox"/> Support</p> <p><input type="checkbox"/> Support with language suggestions</p> <p><input type="checkbox"/> Oppose</p>	