

**ARC TPWG Assessment and Conversion of NERC TPL-002-0 for Alberta TPL-002-AB-0  
System Performance Following Loss of a Single BES Element**

Section	NERC TPL-002-0	Alberta TPL-002-AB-0	Reason for Difference <sup>1</sup>
<b>Purpose</b>	System simulations and associated assessments are needed periodically to ensure that reliable systems are developed that meet specified performance requirements with sufficient lead time, and continue to be modified or upgraded as necessary to meet present and future system needs.	<u>The purpose of this reliability standard is to ensure that a reliable transmission system is planned that</u> meets specified performance requirements, with sufficient lead time. <u>The transmission system must continue to be modified or upgraded as required to</u> meet present and future system specified performance requirements as identified by <del>needs by</del> periodically <del>performing</del> system simulations and associated <u>planning</u> assessments. <u>See TPL-001</u>	Align the purpose with the contents of the reliability standard.
<b>Applicability</b>	4.1 Planning Authority 4.2 Transmission Planner	<u>This reliability standard applies to the ISO.</u>	
<b>Effective Date</b>		<u>365 calendar days after the date of approval by the Commission.</u>	
<b>Definitions</b>		<u>Italicized terms used in this reliability standard have the meanings as set out in the Alberta Reliability Standards Glossary and in Part 1 of the ISO rules<sup>2</sup>.</u>	
<b>Requirement</b>	<b>R1.</b> The Planning Authority and Transmission Planner shall each demonstrate through a valid	<b>R1</b> The ISO must demonstrate <u>for transmission facilities rated 69 kV and</u>	<b>Alberta Variance<sup>3</sup>:</b> To identify the facilities

<sup>1</sup> The following revisions have been made throughout this proposed reliability standard:

- Identified the responsible entities in Alberta.
- Applied a consistent writing style and added clarity.
- Changed passive terms such as “shall” to “must”.

<sup>2</sup> Defined terms are not italicized in this document, but will appear in the Alberta Reliability Standards document.

<sup>3</sup> An Alberta variance is a change from the US Reliability Standard that the AESO has determined is material.

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	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 (nonrecallable reserved) Transmission Services, at all demand levels over the range of forecast system demands, under the contingency conditions as defined in Category B of Table I. To be valid, the Planning Authority and Transmission Planner assessments shall:	<p><del>above,</del> through a <del>valid</del>-planning assessment, that <u>a transmission system</u> is planned such that the <u>transmission system</u> can be operated to accommodate <del>projected-forecasted</del> customer demands, supply and <del>projected-forecasted</del> firm (non-recallable reserved) transmission services, at all demand levels over the range of forecast system demands, under the contingency conditions as defined in Category B of Appendix 1.</p> <p><del>To be valid, the</del>The ISO planning assessments must:</p>	<p>this standard applies to, including 69 kV and 72 kV facilities.</p> <p><b>Alberta Variance<sup>1</sup>:</b> Revised to include the accommodation of generation supply in accordance with Alberta legislation.</p> <p>Changed passive term “shall” to “must”.</p>
<b>Requirement</b>	<p><b>R1.1.</b> Be made annually.</p> <p><b>R1.2.</b> Be conducted for near-term (years one through five) and longer-term (years six through ten) planning horizons.</p> <p><b>R1.3.</b> Be supported by a current or past study and/or system simulation testing that addresses each of the following categories, showing system performance following Category B of Table 1 (single contingencies). The specific elements selected (from each of the following categories) for inclusion in these studies and simulations shall be acceptable to the associated Regional Reliability Organization(s).</p>	<p><b>R1.1</b> Be <u>carried out</u> annually.</p> <p><b>R1.2</b> Be conducted for near term (year one through five) and longer term (year six through ten) planning horizons.</p> <p><b>R1.3</b> Be supported by a <del>current or past</del> study and/or system simulation testing, <u>conducted within the last five years</u>, that addresses each of the <del>following categories</del> requirements <u>in requirement</u> (R1.3.1 to R1.3.12), showing system performance <u>for the conditions defined in Category B of Appendix 1, following Category B of Table 1 (single contingencies). The specific elements selected (from each of the following categories) for inclusion in these</u></p>	<p>Did not need to have a reference to the RRO.</p>

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	<p><b>R1.3.1.</b> Be performed and evaluated only for those Category B contingencies that would produce the more 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.</p>	<p><del>studies and simulations shall be acceptable to the associated Regional Reliability Organization(s).</del></p> <p><b>R1.3.1</b> Be performed and evaluated only for those Category B contingencies that <u>the ISO has determined</u> would produce the more severe system results or impacts. The rationale for the contingencies selected for evaluation <del>must be available as supporting information. An and an</del> explanation of why the remaining simulations would produce less severe system results must be <del>available as supporting information</del> <u>included in the study.</u></p>	<p>The only entity performing the study is the ISO.</p>
<b>Requirement</b>	<p><b>R1.3.2.</b> Cover critical system conditions and study years as deemed appropriate by the responsible entity.</p> <p><b>R1.3.3.</b> Be conducted annually unless changes to system conditions do not warrant such analyses.</p> <p><b>R1.3.4.</b> Be conducted beyond the five-year horizon only as needed to address identified marginal conditions that may have longer lead-time solutions.</p> <p><b>R1.3.5.</b> Have all projected firm transfers modeled.</p> <p><b>R1.3.6.</b> Be performed and evaluated for selected</p>	<p><b>R1.3.2</b> Cover critical system conditions and study years as <del>considered</del> <u>determined necessary by the ISO</u> <del>deemed appropriate by the responsible entity.</del></p> <p><b>R1.3.3</b> Be conducted annually unless <u>the ISO determines that</u> changes to system conditions do not warrant such analyses.</p> <p><b>R1.3.4</b> Be conducted beyond the five-<u>.</u>year horizon only as needed to address identified marginal conditions that may have longer lead time solutions.</p> <p><b>R1.3.5</b> Have all projected firm transfers modeled <u>, if any.</u></p> <p><b>R1.3.6</b> Be performed and evaluated for</p>	

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	demand levels over the range of forecast system Demands.	selected demand levels over the range of forecast system <u>demands as considered necessary by the ISO.</u>	
	<b>R1.3.7.</b> Demonstrate that system performance meets Category B contingencies.	<b>R1.3.7</b> Demonstrate that system performance meets <u>the conditions defined in Category B of Appendix 1. Category B contingencies of Appendix 1.</u>	For clarity and consistency with other TPL standards.
	<b>R1.3.8.</b> Include existing and planned facilities.	<b>R1.3.8</b> Include existing and planned facilities as <u>considered necessary</u> by the ISO.	To clarify the entity responsible for determining planned facilities to be included.
<b>Requirement</b>	<b>R1.3.9.</b> Include Reactive Power resources to ensure that adequate reactive resources are available to meet system performance.	<b>R1.3.9</b> Include reactive power resources to ensure that adequate reactive resources are available to meet system performance.	
<b>Requirement</b>	<b>R1.3.10.</b> Include the effects of existing and planned protection systems, including any backup or redundant systems.	<b>R1.3.10</b> Include the effects of existing and planned protection systems, including any backup or redundant systems.	
	<b>R1.3.11.</b> Include the effects of existing and planned control devices.	<b>R1.3.11</b> Include the effects of existing and planned control devices.	
	<b>R1.3.12.</b> 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.	<b>R1.3.12</b> Include the planned <u>(including maintenance)</u> outage <u>and maintenance</u> of any bulk electric equipment (including protection systems or their components) at those demand levels for which planned (including maintenance) outages are performed. For stations supplied by two lines, if one line is out for maintenance, then those stations are considered to be supplied <u>by a radial line.</u>	

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	<p><b>R1.4.</b> Address any planned upgrades needed to meet the performance requirements of Category B of Table I.</p>	<p><b>R1.4</b> Address any planned upgrades needed to meet the performance requirements <u>for the conditions defined in Category B of Appendix 1 of Category B of Appendix I.</u></p>	
	<p><b>R1.5.</b> Consider all contingencies applicable to Category B.</p>	<p><b>R1.5</b> Consider all contingencies applicable to Category B <u>of Appendix 1.</u></p>	
<b>Measure</b>	<p><b>M1.</b> The Planning Authority and Transmission Planner shall have a valid assessment and corrective plans as specified in Reliability Standard TPL-002-0_R1 and TPL-002-0_R2.</p>	<p><del><b>M1.</b> The Planning Authority and Transmission Planner shall have a valid assessment and corrective plans as specified in Reliability Standard TPL-002-0_R1 and TPL-002-0_R2.</del></p> <p><b>MR1.</b> The planning assessment will be valid and meet requirements in R1 through the following measures:</p> <ul style="list-style-type: none"> <li>• The scope of the planning assessment identifies where area studies have been conducted in the past year. <u>It also identifies</u> area studies that have been conducted in <u>previous</u> years and are still <u>valid</u>. Where area studies have not been conducted, a plan and schedule to conduct one is included in the planning assessment.</li> <li>• The planning assessment includes time horizons as specified in R1.2</li> </ul>	Expanded Measures

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		<ul style="list-style-type: none"> <li>The planning <u>has been prepared</u> within the last year.</li> <li>A certification that the planning assessment complies with each of the R1 technical requirements is provided and states that the planning assessment meets all requirements, identifies requirements not met, and states reasons where the requirement was not met.</li> <li>A summary list of supporting area studies and needs identification documents is provided. The summary list includes the title and date of the study. The area studies and needs identification documents <u>are</u> provided if requested.</li> </ul>	
<b>Requirement</b>	<p><b>R2.</b> When System simulations indicate an inability of the systems to respond as prescribed in Reliability Standard TPL-002-0_R1, the Planning Authority and Transmission Planner shall each:</p> <p><b>R2.1.</b> Provide a written summary of its plans to achieve the required system performance as described above throughout the planning horizon:</p>	<p><b>R2</b> When System simulations indicate an inability of the systems to respond as <u>set out in R1.3.7 of this reliability standard the ISO must:</u></p> <p><b>R2.1</b> Provide <u>a written summary of its corrective</u> plans to achieve the required system performance as described above throughout the planning horizon:</p>	<p>To clarify the entity responsible for determining planned facilities to be included.</p> <p>Clarify that “corrective” plans is what is being referred to. Removed written summary as corrective plans are in the</p>

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	<p><b>R2.1.1.</b> Including a schedule for implementation.</p> <p><b>R2.1.2.</b> Including a discussion of expected required in-service dates of facilities.</p>	<p><b>R2.1.1</b> Including a schedule for implementation.</p> <p><b>R2.1.2</b> Including a discussion of expected required in service dates of facilities.</p>	documents as identified in R2.
<b>Requirement</b>	<p><b>R2.1.3.</b> Consider lead times necessary to implement plans.</p> <p><b>R2.2.</b> Review, in subsequent annual assessments, (where sufficient lead time exists), the continuing need for identified system facilities. Detailed implementation plans are not needed.</p>	<p><b>R2.1.3</b> Consider lead times necessary to implement corrective plans.</p> <p><b>R2.2</b> Review, in subsequent annual assessments, where sufficient lead time exists, the continuing need for identified system facilities. Detailed implementation plans are not needed.</p>	
<b>Measure</b>		<p><u><b>MR2</b> The area studies and needs identification documents contain recommendations and projects for the corrective plans where an inability of the systems to respond to requirements specified in R1 has been identified. The area studies and needs identification documents must be provided on request. The area studies and needs identification documents contain the technical components as specified in R2 and its subsections.</u></p>	Developed measures specific to the requirement.
<b>Requirement</b>	<p><b>R3.</b> The Planning Authority and Transmission Planner shall each document the results of its Reliability Assessments and corrective plans and shall annually provide the results to its respective</p>	<p><del><b>R3</b> The Planning Authority and Transmission Planner shall each document the results of its Reliability Assessments and corrective plans and shall annually</del><u>ISO</u></p>	<p><b>R3</b> Identify responsible entity in Alberta and the reporting relationship.</p>

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	Regional Reliability Organization(s), as required by the Regional Reliability Organization.	<del>must</del> provide the <del>results to its respective Regional Reliability Organization(s), as required by the Regional Reliability Organization</del> <u>planning assessment to the WECC on an annual basis.</u>	
<b>Measure</b>	<b>M2.</b> The Planning Authority and Transmission Planner shall have evidence it reported documentation of results of its reliability assessments and corrective plans per Reliability Standard TPL-002-0_R3.	<del>MR3.</del> A written or email confirmation from WECC <del>(as the RE)</del> that it has received the planning assessment from the ISO. The confirmation includes the date of when the planning assessment was received and source identification information. <del>The Planning Authority and Transmission Planner shall have evidence it reported documentation of results of its reliability assessments and corrective plans per Reliability Standard TPL-002-0_R3.</del>	
<b>Procedures</b>			
<b>Compliance</b>	To view the compliance section D of the NERC reliability standard follow this link: <a href="http://www.nerc.com/files/TPL-002-0.pdf">http://www.nerc.com/files/TPL-002-0.pdf</a>		There is no compliance section currently proposed in the Alberta Reliability Standards.  A compliance program will be developed at a later date for Alberta Reliability Standards that recognizes the compliance monitoring and enforcement structure in Alberta.

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			This approach is deemed consistent with the existing ISO Rules.
<b>Regional Differences</b>	None identified.		Not applicable in Alberta

**Table 1-Appendix 1 - Transmission System Standards – Normal and Emergency Conditions**

Category	Contingencies	System Limits or Impacts		
	Initiating Event(s) and Contingency Element(s)	System Stable and Both Thermal and Voltage Limits Within Applicable Rating <sup>a</sup>	Loss of Demand or Curtailed Firm Transmission Service Transfers	Cascading
<b>A</b> No contingencies	All facilities in service	Yes	No	No
<b>B</b> Event resulting in the loss of a single element	Single Line Ground (SLG) or 3-Phase (3Ø) fault, with normal clearing: 1. Generator 2. Transmission circuit 3. Transformer	Yes Yes Yes Yes	No <sup>b</sup> No <sup>b</sup> No <sup>b</sup> No <sup>b</sup>	No No No No
<b>C</b> Event(s) resulting in the loss of two or more (multiple) elements	SLG fault, with normal clearing <sup>e</sup> : 1. Bus section 2. Breaker (failure or internal fault)	Yes Yes	Planned/ Controlled <sup>c</sup> Planned/ Controlled <sup>c</sup>	No No
	SLG or 3Ø fault, with normal clearing <sup>e</sup> , manual system adjustments, followed by another SLG or 3Ø fault, with normal clearing <sup>e</sup> 3. Category B (B1, B2, B3, or B4) contingency, manual system adjustments, followed by another Category B (B1, B2, B3, or B4) contingency	Yes	Planned/ Controlled <sup>c</sup>	No
	Bipolar block, with normal clearing <sup>e</sup> :			
	4. Bipolar (dc) line fault (non 3Ø), with normal clearing <sup>e</sup> : 5. Any two circuits of a multiple circuit towerline <sup>f</sup>	Yes Yes	Planned/ Controlled <sup>c</sup> Planned/ Controlled <sup>c</sup>	No No
	SLG fault, with delayed clearing <sup>e</sup> (stuck breaker or protection system failure) 6. Generator 7. Transformer	Yes Yes	Planned/ Controlled <sup>c</sup> Planned/ Controlled <sup>c</sup>	No No
	8. Transmission circuit	Yes	Planned/ Controlled <sup>c</sup>	No
	9. Bus section	Yes	Planned/ Controlled <sup>c</sup>	No

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

- a) Applicable rating refers to the applicable normal and emergency facility thermal and voltage rating as applied by the facility owner or system voltage limit as determined and consistently applied by the ISO. Applicable ratings may include emergency ratings applicable for short durations as required to permit operating steps necessary to maintain system control. All ratings must be established by the applicable entity consistent with applicable ISO rules addressing facility ratings.
- b) Planned or controlled interruption of electric supply to radial customers or some local network customers, connected to or supplied by the faulted element or by the affected area, may occur in certain areas without impacting the overall reliability of the interconnected transmission systems. To prepare for the next contingency, system adjustments are permitted, including curtailments of contracted firm (non-recallable reserved) transmission service electric power transfers.
- c) Depending on system design and expected system impacts, the controlled interruption of electric supply to customers (load shedding), the planned removal from service of certain generators, and/or the curtailment of contracted firm (non-recallable reserved) transmission service electric power transfers may be necessary to maintain the overall reliability of the interconnected transmission systems.
- d) A number of extreme contingencies that are listed under Category D and judged to be critical by the transmission planning entity(ies) will be selected for evaluation. It is not expected that all possible facility outages under each listed contingency of Category D will be evaluated.
- e) Normal clearing is when the protection system operates as designed and the fault is cleared in the time normally expected with proper functioning of the installed protection systems. Delayed clearing of a fault is

due to failure of any protection system component such as a relay, circuit breaker, or current transformer, and not because of an intentional design delay.

- f) System assessments may exclude these events where multiple circuit towers are used over short distances (i.e., station entrance, river crossings) in accordance with exemption criteria.

### **Proposed Terms for the ARS Glossary:**

“demand” – means:

- The rate at which electric energy is delivered to or by a system or part of a system, generally expressed in kilowatts or megawatts, at a given instant or averaged over any designated interval of time.
- The rate at which electric energy is being used by the demand customer.

“element” - means any electrical device, comprised of one or more components, with terminals that may be connected to other electrical devices such as a generating unit, transformer, circuit breaker, bus section, or transmission line.

“facility” - means a set of electrical equipment that operates as a single bulk electric system element, including without limitation, a transmission line, generating unit, a-shunt compensator, or transformer.

“misoperation” means any one of the following:

- Any failure of a protection system element to operate within the specified time when a fault or abnormal condition occurs within a zone of protection.
- Any operation for a fault not within a zone of protection, except an operation as backup protection for a fault in an adjacent zone that is not cleared within a specified time for the protection for that zone.
- Any unintentional protection system operation when no fault or other abnormal condition has occurred unrelated to on-site maintenance and testing activity.

“normal clearing” - means that a protection system operates as designed and the *fault* is cleared in the time normally expected with proper functioning of the installed protection systems.

“protection system” - means protective relays, associated communication systems, voltage and current sensing devices, station batteries and DC control circuitry.

**Existing Defined Terms Used in this Standard:**

(As included in the ISO Rules Definitions or Alberta Reliability Standards Glossary)

- cascading\*
- contingency\*
- ISO
- load
- outage
- remedial action scheme (RAS)
- rating\*
- reliability
- reliability standard
- Western Electricity Coordinating Council (WECC)

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\* Term appears in the Alberta Reliability Standards Glossary of Terms – April 2009 rules cycle.