

# Information Document

## PRC-001-AB3-1.1(ii) Protection System Coordination

### ID #2010-006RS



Information Documents are not authoritative. Information Documents are for information purposes only and are intended to provide guidance. In the event of any discrepancy between an Information Document and any Authoritative Document(s)<sup>1</sup> in effect, the Authoritative Document(s) governs.

#### 1 Purpose

This Information Document relates to the following Authoritative Document:

- Alberta Reliability Standard PRC-001-AB3-1.1(ii), *Protection System Coordination* (“PRC-001”).

The purpose of this Information Document is to provide information regarding the coordination of protection systems among operating entities. This Information Document also provides a link to the List of Additional Facilities referred to in the Applicability section of PRC-001. This Information Document is likely of most interest to the legal owners and operators of transmission facilities, generating units and aggregated generating facilities in Alberta.

#### 2 List of Additional Facilities (Applicability)

A List of Additional Facilities, as referenced in subsections 2(a)(ii)(B), (b)(iv), (c)(iv), (d)(ii)(B), (e)(iv) and (f)(iv) of PRC-001, is posted on the AESO website at: List of Additional Facilities PRC-001-AB3-1.1(ii)

#### 3 Supplemental Information for Certain Requirements of PRC-001

##### 3.1 Notification of Failure (Requirement R2 and R2.1)

Notification to the AESO of a failure described in requirements R2(a), R2(b) and R2(d), is to the AESO’s System Coordination Centre by phone, followed by an email to the AESO’s Operations Engineering group at [ops.eng@aesO.ca](mailto:ops.eng@aesO.ca).

Notification to the AESO of a failure described in requirement R2(c) is by email to the AESO’s Operations Engineering group at [ops.eng@aesO.ca](mailto:ops.eng@aesO.ca).

The AESO requests that a market participant wishing to use SCADA to provide notifications to the AESO for specific facilities receive the AESO’s agreement in advance, as modifications to the AESO’s SCADA system may be required.

Following receipt of notification, and if the operator of a transmission facility has not already done so, the AESO may, in accordance with Section 305.4 of the ISO rules, *System Security*, issue a directive instructing that the transmission facility be taken out of service until the repairs are complete.

Requirement R2(a) refers to a protection system that protects a specific transmission facility and as such does not include remedial action schemes. Remedial action schemes are installed primarily to protect the Alberta interconnected electric system, or a portion thereof, by maintaining stability, maintaining acceptable transmission system voltage levels, maintaining acceptable transmission system power flows and limiting the impact of cascading or extreme events.

##### 3.2 Provision of New Estimate to Return to Service (Requirement R2.2)

The provision of a new estimate of the return to service date to the AESO, as described in requirement R2.2, is by email to the AESO’s Operations Engineering group at [ops.eng@aesO.ca](mailto:ops.eng@aesO.ca).

##### 3.3 Coordination of Generating Unit Protection System Changes (Requirement R3)

For projects following the AESO’s customer connection processes, including behind-the-fence and market participant choice, or the AESO’s system connection projects, all communications to the AESO confirming protection system coordination with the affected parties pursuant to requirement

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<sup>1</sup> “Authoritative Documents” is the general name given by the AESO to categories of documents made by the AESO under the authority of the *Electric Utilities Act* and regulations, and that contain binding legal requirements for either market participants or the AESO, or both. AESO Authoritative Documents include: the ISO rules, the Alberta reliability standards, and the ISO tariff.

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R3, is by email to the AESO's Project Manager.

All other communications to the AESO confirming protection system coordination with the affected parties pursuant to requirement R3 is by email to [PRC-001@aeso.ca](mailto:PRC-001@aeso.ca).

The AESO generally agrees with the information contained in the NERC [Power Plant and Transmission System Protection Coordination](#) technical reference document and recognizes that it may be a useful reference for the legal owner of a generating and the legal owner of an aggregated generating facility in coordinating protection systems with affected interconnecting legal owners of transmission facilities under requirement R3. As with every Alberta reliability standard, each responsible entity is responsible for determining, for its facilities, what actions are necessary to meet the requirements in PRC-001.

The legal owner of a generating unit or a legal owner of an aggregated generating facility, who also owns protection systems associated with transmission facilities, must ensure the protection systems of its generating unit or aggregated generating facility are coordinated with the protection systems of its transmission facilities.

Examples of how the legal owner of a generating unit or the legal owner of an aggregated generating facility may establish which protection system changes are to be coordinated with the affected parties can be found in Appendix 1, *Examples for PRC-001-AB3-1.1(ii) Requirement R3 – Guidelines for Protection System Change Coordination and Notification by the Legal Owner of a Generating Unit or Aggregated Generating Facility* ("Appendix 1"). These examples in Appendix 1 were developed by an industry work group to assist market participants in determining when protection system changes may affect others and require coordination with the affected parties in accordance with requirement R3. As with every Alberta reliability standard, each responsible entity is responsible for determining, for its facilities, what actions are necessary to meet the requirements in PRC-001.

#### **3.4 Coordination of Transmission Facility Protection System Changes (Requirement R4)**

For projects following the AESO's customer connection processes, including behind-the-fence projects, all information exchanges confirming protection system coordination with the AESO pursuant to requirement R4 is to the AESO's Project Manager.

All other communications to the AESO confirming protection system coordination with the affected parties pursuant to requirement R4 is by email to [PRC-001@aeso.ca](mailto:PRC-001@aeso.ca).

The AESO generally agrees with the information contained in the NERC [Power Plant and Transmission System Protection Coordination](#) technical reference document and recognizes that it may be a useful reference for the legal owner of a transmission facility in coordinating protection systems with affected parties under requirement R4. As with every Alberta reliability standard, each responsible entity is responsible for determining, for its facilities, what actions are necessary to meet the requirements in PRC-001.

Examples of how the legal owner of a transmission facility may establish which protection system changes are to be coordinated with the affected parties, other than the AESO, can be found in Appendix 2, *Examples for PRC-001-AB3-1.1(ii) Requirement R4 – Guidelines for Protection System Change Coordination and Notification by the Legal Owner of a Transmission Facility*. The examples in Appendix 2 were developed by an industry work group to assist market participants in determining when protection system changes may affect others and require coordination with the affected parties, in accordance with requirement R4.

Examples of protection system changes that affect the AESO include protection system changes to:

- synch-check relays;
- transmission system synchronizer relays;
- power swing relays;
- underfrequency load shed relays that are part of the AESO's underfrequency load shedding

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program; and

- under voltage load shed relays that are part of the AESO's under voltage load shed program.

As with every Alberta reliability standard, each responsible entity is responsible for determining, for its facilities, what actions are necessary to meet the requirements in PRC-001.

### 3.5 Coordination of Changes in the Operating Conditions of Generating Units and Aggregated Generating Facilities (Requirement R5.1)

Most generating units and aggregated generating facilities in Alberta are designed such that planned changes in generation, load, or operating conditions do not affect the protection systems of others. If, however, the operator of a generating unit or the operator of an aggregated generating facility identifies a planned change that would require a notification to the AESO pursuant to requirement R5.1, such notification is by email to the AESO's Operations Coordination group at [ops.coordination@aesocanada.com](mailto:ops.coordination@aesocanada.com).

### 3.6 Coordination of Changes in the Operating Conditions of Transmission Facilities (Requirement R5.2)

Most transmission facilities in Alberta are designed such that planned changes in transmission, load, or operating conditions do not affect protection systems of others. If, however, an operator of a transmission facility identifies a planned change that would require a notification to the AESO pursuant to requirement R5.2, such notification is by email to the AESO's Operations Coordination group at [ops.coordination@aesocanada.com](mailto:ops.coordination@aesocanada.com).

### 3.7 Monitoring and Reporting of Remedial Action Scheme Status (Requirement R6)

For remedial action scheme status changes in real time, the notification provided pursuant to requirement R6, is to the AESO's System Coordination Centre. This may be done either by a discrete SCADA point to the system controller or by phone call.

For remedial action scheme status changes arising from scheduled outages or commissioning activities, the notification provided pursuant to requirement R6, is by email to the AESO's Operations Coordination group at [outage.scheduling@aesocanada.com](mailto:outage.scheduling@aesocanada.com).

Notifications for changes in status to new remedial action schemes will be managed as part of the AESO's connection, behind the fence or system project processes.

## 4 Appendices

Appendix 1 – *Examples for PRC-001-AB3-1.1(ii) Requirement R3 – Guidelines for Protection System Change Coordination and Notification by the Legal Owner of a Generating Unit or Aggregated Generating Facility*

Appendix 2 – *Examples for PRC-001-AB3-1.1(ii) Requirement R4 – Guidelines for Protection System Change Coordination and Notification by the Legal Owner of a Transmission Facility*

### Revision History

Posting Date	Description of Changes
October 4, 2017	Revised to align with new version of PRC-001-AB3-1.1(ii) Other administrative amendments
July 5, 2012	Added section on "Additional Applicable Facilities"
Concurrent with PRC-001-AB1-1	
September 30, 2010	Further detail provided for R2, R3, R5, R6, R8 & R9. Link updated to final NERC document. Examples referenced regarding when to

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exchange settings.

November 15, 2010 Initial version

**Appendix 1**

**Examples for PRC-001-AB3-1.1(ii) Requirement R3 – Guidelines for Protection System Change Coordination by the Legal Owner of a Generating Unit or Aggregated Generating Facility**

The examples in the table below were developed by an industry work group to assist market participants in determining when protection system changes may affect others and require coordination with the affected parties in accordance with requirement R3 of PRC-001. As with every Alberta reliability standard, each responsible entity is responsible for determining, for its facilities, what actions are necessary to meet the requirements in PRC-001.

An example of a typical protection system for a generating unit is provided in Figure 1 for ease of reference.

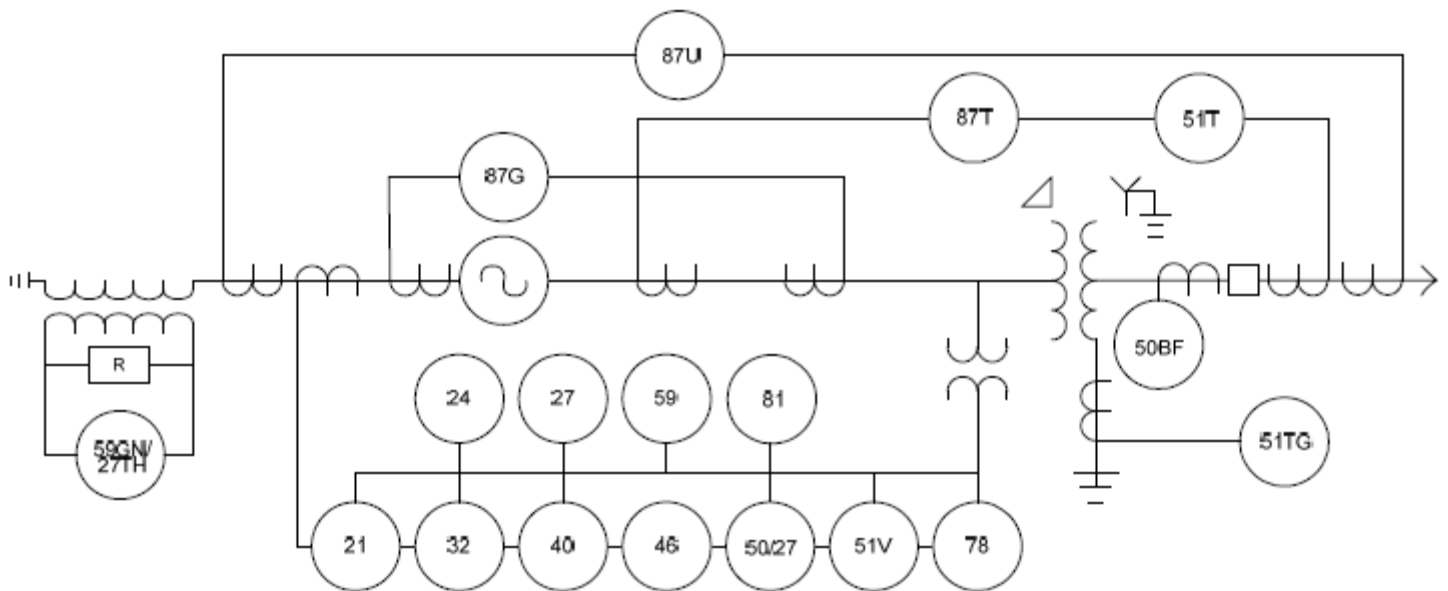
**Relay Setting Coordination**

<b>Protection System</b>	<b>Coordinate with Affected Parties</b>	<b>Not Likely to Affect Other Parties</b>
Function 21 Relay Generator Phase Distance		Change of R-X plane trip setting in primary ohms at the generator terminals
		Change of relay trip timer settings
		Change in total clearing times for the generator breakers Relay
Function 21L Relay Line Phase Distance	Change of impedance trip zone reach settings	
	Change of relay trip zone timer settings	
Function 24 Relay		Change of V/Hz trip setting
Overexcitation (Volts/Hz)		Change of relay trip timer setting
		Change of relay inputs
Function 27 Relay Generator Unit UV(undervoltage)	Change of voltage trip primary setting	
	Change of relay trip timer setting	
Plant Auxiliary MV System UV	Change of voltage primary setting	
	Change of relay timer setting	
High Voltage Side UV	Change of voltage trip primary setting	
	Change of relay trip timer setting	
Function 32 Relay Reverse Power		Change of reverse power setting in percentage and relay timer setting
Function 40 Relay Loss of Field (LOF)		Change of impedance trip zone reach
		Change of relay trip timer setting

Protection System	Coordinate with Affected Parties	Not Likely to Affect Other Parties
Function 46 Relay Negative Phase Sequence overcurrent		Change of negative phase sequence overcurrent alarm/trip setting
		Change of relay trip timer setting
Function 50/27 Relay Inadvertent Energizing		Change of undervoltage setting
		Change of current detector pick up setting
		Change of relay timer setting
Function 50/51L Transmission Line O/C Relay	Change of O/C trip settings	
	Change of relay trip timer settings	
Function 50BF Relay Breaker Failure	Change of relay trip timer setting	
Function 50/51T/51TG Relay Back up Overcurrent for GSU	Change of phase overcurrent trip primary setting	
	Change of ground overcurrent trip setting	
	Change of relay trip timer setting	
	Change in total clearing time for generator breaker	
Function 51V Relay Voltage Controlled/Restrained Overcurrent		Change of controlled/restrained voltage trip primary setting
		Change of overcurrent trip primary setting
		Change of relay trip timer setting
Function 59 Relay Overvoltage	Change of over-voltage trip primary setting	
	Change of relay trip timer setting	
Function 59GN/27 Relay Stator Ground		Change of relay timer setting
Function 78 Relay Out of Step		Change of impedance trip zone blinder setting
		Change of relay trip timer setting
		Change on protection scheme
Function 81 Relay Over/Under frequency		Change of frequency trip setting
		Change of relay trip time setting

Protection System	Coordinate with Affected Parties	Not Likely to Affect Other Parties
Function 87L Relay Transmission Line Differential		No notification is required for protection setting change of any existing differential protection

**Figure 1 - Typical Protection System for a Generating Unit**



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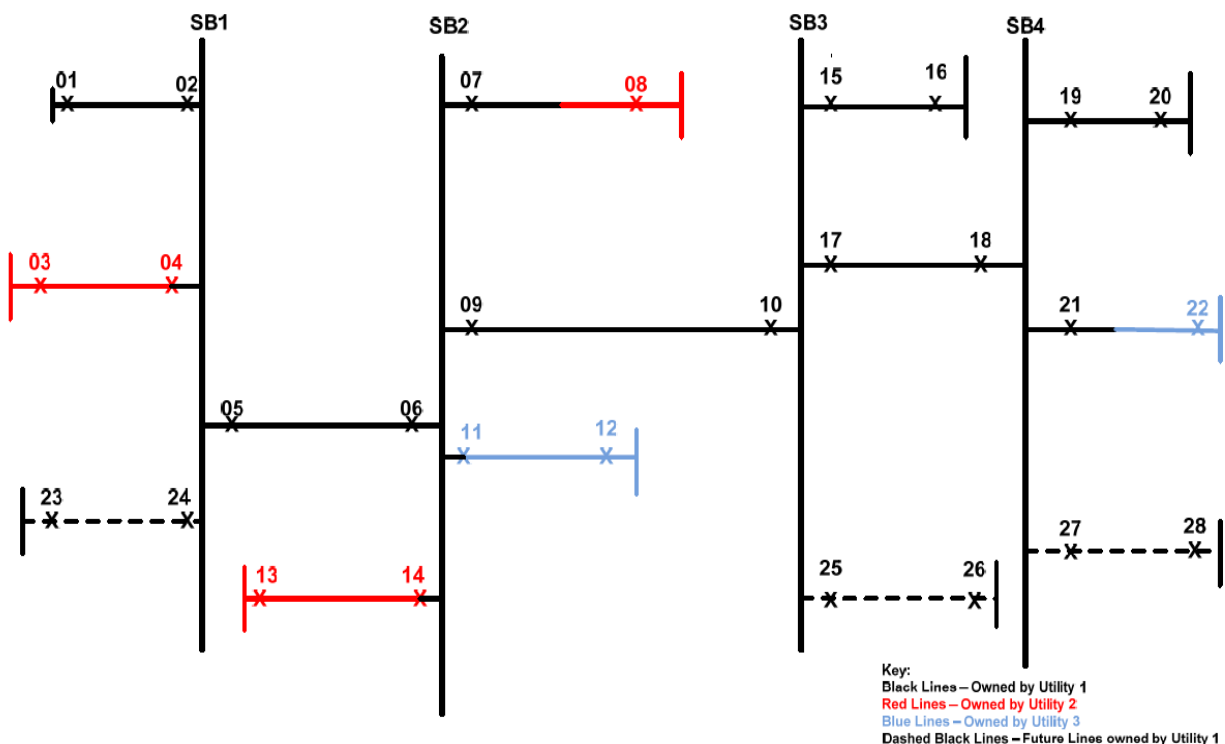


### Appendix 2

#### Examples for PRC-001-AB3-1.1(ii) Requirement R4 – Guidelines for Protection System Change Coordination and Notification by the Legal Owner of a Transmission Facility

The examples in the table below were developed by an industry work group to assist market participants in determining when protection system changes may affect others and require coordination with the affected parties in accordance with requirement R4 of PRC-001. As with every Alberta reliability standard, each responsible entity is responsible for determining, for its facilities, what actions are necessary to meet the requirements in PRC-001.

#### PRC-001 R4: Protection Coordination Requirement for Notification: Power System Element(s) & Bus(es) Defined



#### Diagram Information:

- 4 Substation Buses: SB1 is Substation Bus 1, SB2 is Substation Bus 2, SB3 is Substation Bus 3, and SB4 is Substation Bus 4.
- Terminals: SB1 has 4 terminals, SB2 has 5 terminals, SB3 has 4 terminals, and SB4 has 4 terminals.
- 14 Lines: Line 01-02, Line 03-04, Line 05-06, Line 07-08, Line 09-10, Line 11-12, Line 13-14, Line 15-16, Line 17-18, Line 19-20, Line 21-22, Line 23-24, Line 25-26, and Line 27-28.

#### Interconnecting and Non-interconnecting Bus/Elements:

- Interconnecting Bus is: A substation bus with connected terminals that belong to more than one utility. Examples: SB1 and SB2.
- Non-interconnecting Bus is: A substation bus with connected terminals that belong to only one utility. Examples: SB3 and SB4.



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- Power System Elements: For simplicity, only elements with 2 terminals are considered. Therefore, only 2-terminal lines are indicated in the diagram.
- Interconnecting Element is: A Power System Element with connected terminals that belong to more than one utility. Examples: Line 07-08 and Line 21-22.
- Non-interconnecting Element is: A Power System Element with connected terminals that belong to only one utility. Examples: Line 01-02, Line 03-04, Line 05-06, Line 09-10, Line 11-12, Line 13-14, Line 15-16, Line 17-18, Line 19-20, Line 23-24, Line 25-26 and Line 27-28.

The following six examples indicate when to coordinate with affected parties in accordance with requirement R4:

<p><b>For Terminal 05 (Connected to SB1):</b>          The Remote Terminal is: 06          The Upstream terminals are: 01, 03 &amp; 23          The Downstream terminals are: 07, 09, 11 &amp; 14          (Note: All four terminals are connected to SB2) The “Same Bus” Adjacent terminals are: 02, 04 &amp; 24          If protection settings are to be changed (or added) at terminal 05:  <b>Coordinate with the owners of terminals 03, 11, 14 &amp; 04.</b></p>	<p><b>For Terminal 06 (Connected to SB2):</b>          The Remote Terminal is: 05          The Upstream terminals are: 08, 10, 12 &amp; 13          The Downstream terminals are: 02, 04 &amp; 24 (Note: All three terminals are connected to SB1) The “Same Bus” Adjacent terminals are: 07, 09, 11 &amp; 14          If protection settings are to be changed (or added) at terminal 06:  <b>Coordinate with the owners of terminals 08, 12, 13, 04, 11 &amp; 14.</b></p>
<p><b>For Terminal 09 (Connected to SB2):</b>          The Remote Terminal is: 10          The Upstream terminals are: 08, 05, 12 &amp; 13          The Downstream terminals are: 15, 17 &amp; 25 (Note: All three terminals are connected to SB3) The “Same Bus” Adjacent terminals are: 06, 07, 11 &amp; 14          If protection settings are to be changed (or added) at terminal 09:  <b>Coordinate with the owners of terminals 08, 12, 13, 11 &amp; 14.</b></p>	<p><b>For Terminal 10 (Connected to SB3):</b>          The Remote Terminal is: 09          The Upstream terminals are: 16, 18, &amp; 26          The Downstream terminals are: 07, 06, 11 &amp; 14 (Note: All four terminals are connected to SB2) The “Same Bus” Adjacent terminals are: 15, 17 &amp; 25          If protection settings are to be changed (or added) at terminal 10:  <b>Coordinate with the owners of terminals 11 &amp; 14.</b></p>