1. Purpose

The purpose of this **reliability standard** is to ensure that adequate data is available to facilitate analysis of **disturbances** on the **bulk electric system**.

2. Applicability

This **reliability standard** applies to the following:

(a) the **legal owner** of a **transmission facility** that is part of the **bulk electric system**;

(b) the **legal owner** of a **generating unit** that is part of the **bulk electric system**;

(c) the **legal owner** of an **aggregated generating facility** that is part of the **bulk electric system**; and

(d) the **ISO**.

3. Requirements

R1 Each **legal owner** of a **transmission facility** must:

R1.1 identify **bulk electric system** buses for which sequence of events recording and **fault** recording data is required by using the methodology in Appendix 1;

R1.2 notify other **legal owners** of **system elements** on the **bulk electric system** connected to those **bulk electric system** buses, if any, within 90 **days** of completion of requirement R1.1, that those **system elements** require either one or both of sequence of events recording data and **fault** recording data; and

R1.3 re-evaluate all **bulk electric system** buses at least once every 5 calendar years in accordance with requirement R1.1 and notify other **legal owners**, if any, in accordance with requirement R1.2, and implement the re-evaluated list of **bulk electric system** buses as per the *Implementation Plan* in Appendix 2.

R2 Each **legal owner** of a **transmission facility**, **legal owner** of a **generating unit**, and **legal owner** of an **aggregated generating facility** must have sequence of events recording data for circuit breaker position, open or close, for each circuit breaker it owns connected directly to the **bulk electric system** buses identified in requirement R1 and associated with the **system elements** on the **bulk electric system** at those **bulk electric system** buses.

R3 Each **legal owner** of a **transmission facility**, **legal owner** of a **generating unit**, and **legal owner** of an **aggregated generating facility** must have **fault** recording data to determine the following electrical quantities for each triggered **fault** recording for the **system elements** on the **bulk electric system** it owns connected to the **bulk electric system** buses identified in requirement R1:

R3.1 phase-to-neutral voltage for each phase of each specified **bulk electric system** bus; and

R3.2 each phase current and the residual or neutral current for the following **system elements** on the **bulk electric system**:

R3.2.1 transformers that have a low-side operating voltage of 100 kV or above; and

R3.2.2 transmission lines.

R4 Each **legal owner** of a **transmission facility**, **legal owner** of a **generating unit**, and **legal owner** of an **aggregated generating facility** must have **fault** recording data as specified in requirement R3 that meets the following:

R4.1 a single record or multiple records that include:

(a) a pre-trigger record length of at least 2 cycles and a total record length of at least 30 cycles for the same trigger point, or

(b) at least 2 cycles of the pre-trigger data, the first 3 cycles of the post-trigger data, and the final cycle of the **fault** as seen by the **fault** recorder;

R4.2 a minimum recording rate of 16 samples per cycle; and

R4.3 trigger settings for at least the following:

R4.3.1 neutral (residual) overcurrent; and

R4.3.2 phase under voltage or overcurrent**.**

R5 The **ISO** must:

R5.1 identify **system elements** on the **bulk electric system** for which dynamic **disturbance** recording data is required, including the following:

R5.1.1 generating resources with:

R5.1.1.1 an individual **generating unit** with a **maximum authorized real power** rating greater than or equal to 450 MW; and

R5.1.1.2 an individual **generating unit** with a **maximum authorized real power** rating greater than or equal to 270 MW where the plant/facility aggregate **maximum authorized real power** rating is greater than or equal to 900 MW;

R5.1.2 any one **system element** on the **bulk electric system** that is part of an angular stability or voltage stability related **system operating limit**;

R5.1.3 each terminal of a high voltage direct current circuit with a nameplate rating greater than or equal to 270 MW, on the alternating current portion of the converter;

R5.1.4 one or more **system elements** on the **bulk electric system** that are part of an **interconnection reliability operating limit**; and

R5.1.5 any one **system element** on the **bulk electric system** within a major voltage sensitive area as defined by an area with an in-service **under voltage load shed** program;

R5.2 identify a minimum dynamic **disturbance** recording coverage, inclusive of those **system elements** on the **bulk electric system** identified in requirement R5.1, of at least:

R5.2.1 one **system element** on the **bulk electric system**; and

R5.2.2 one **system element** on the **bulk electric system** per 3,000 MW of the **ISO**'s historical simultaneous peak **demand** of the **interconnected electric system**;

R5.3 notify all **legal owners** of identified **system elements** on the **bulk electric system**, within 90 **days** of completion of requirement R5.1, that their respective **system elements** on the **bulk electric system** require dynamic **disturbance** recording data when requested; and

R5.4 re-evaluate all **system elements** on the **bulk electric system** at least once every 5 calendar years in accordance with requirements R5.1 and R5.2, and notify **legal owners** in accordance with requirement R5.3 to implement the re-evaluated list of **system elements** on the **bulk electric system** as per the implementation plan in Appendix 2.

R6 Each **legal owner** of a **transmission facility** must have dynamic **disturbance** recording data to determine the following electrical quantities for each **system element** on the **bulk electric system** it owns for which it received notification as identified in requirement R5:

R6.1 one phase-to-neutral or positive sequence voltage;

R6.2 the phase current for the same phase at the same voltage corresponding to the voltage in requirement R6.1, or the positive sequence current;

R6.3 real power and **reactive power** flows expressed on a 3-phase basis corresponding to all circuits where current measurements are required; and

R6.4 frequency of any one of the voltages in requirement R6.1.

R7 Each **legal owner** of a **generating unit** and **legal owner** of an **aggregated generating facility** must have dynamic **disturbance** recording data to determine the following electrical quantities for each **system element** on the **bulk electric system** it owns for which it received notification as identified in requirement R5:

R7.1 one phase-to-neutral, phase-to-phase, or positive sequence voltage at either the generator step-up transformer high-side or low-side voltage level;

R7.2 the phase current for the same phase at the same voltage corresponding to the voltage in requirement R7.1, phase currents for any phase-to-phase voltages, or positive sequence current;

R7.3 real power and **reactive power** flows expressed on a 3-phase basis corresponding to all circuits where current measurements are required; and

R7.4 frequency of at least one of the voltages in requirement R7.1.

R8 Each **legal owner** of a **transmission facility**, **legal owner** of a **generating unit**, and **legal owner** of an **aggregated generating facility** responsible for dynamic **disturbance** recording data for the **system elements** on the **bulk electric system** for which it received notification as identified in requirement R5 must, unless it complies with subsection 7(1) of Section 502.9 of the **ISO rules**, *Synchrophasor Measurement Unit Technical Requirements*, have continuous data recording and storage, unless the equipment was installed prior to the effective date of this **reliability standard** and is not capable of continuous recording, in which case, triggered records must meet the following:

R8.1 triggered record lengths of at least 3 minutes; or

R8.2 at least one of the following 3 triggers:

(a) off nominal low frequency trigger set at < 59.55 Hz and off nominal high frequency trigger set at > 61.0 Hz;

(b) rate of change of frequency trigger set at < -0.05625 Hz/sec and > 0.125 Hz/sec; or

(c) undervoltage trigger set no lower than 85% of normal operating voltage for a duration of 5 seconds.

R9 Each **legal owner** of a **transmission facility**, **legal owner** of a **generating unit**, and **legal owner** of an **aggregated generating facility** responsible for dynamic **disturbance** recording data for the **system elements** on the **bulk electric system** identified in requirement R5 must have dynamic **disturbance** recording data that meet the following:

R9.1 input sampling rate of at least 960 samples per second; and

R9.2 output recording rate of electrical quantities of at least 30 times per second.

R10 Each **legal owner** of a **transmission facility**, **legal owner** of a **generating unit**, and **legal owner** of an **aggregated generating facility** must time synchronize all sequence of events recording and **fault** recording data for the **bulk electric system** buses identified in requirement R1 and dynamic **disturbance** recording data for the **system elements** on the **bulk electric system** identified in requirement R5 to meet the following:

R10.1 synchronization to Coordinated Universal Time with or without a local time offset; and

R10.2 synchronized device clock accuracy within ± 2 milliseconds of Coordinated Universal Time.

R11 Each **legal owner** of a **transmission facility**, **legal owner** of a **generating unit**, and **legal owner** of an **aggregated generating facility** must provide to the **ISO**, upon written request, all sequence of events recording and **fault** recording data for the **bulk electric system** buses identified in requirement R1 and dynamic **disturbance** recording data for the **system elements** on the **bulk electric system** identified in requirement R5, in accordance with the following:

R11.1 data is retrievable for the period of 10 **days**, inclusive of the **day** the data was recorded;

R11.2 data subject to requirement R11.1 is provided within 30 **days** of a request unless an extension is granted by the **ISO**;

R11.3 sequence of events recording data are provided in ASCII Comma Separated Value format following Appendix 3;

R11.4 **fault** recording and dynamic **disturbance** recording data are provided in electronic files that are formatted in conformance with C37.111, *IEEE Standard for Common Format for Transient Data Exchange (COMTRADE)*, revision C37.111-1999 or later; and

R11.5 data files will be named in conformance with C37.232, *IEEE Standard for Common Format for Naming Time Sequence Data Files (COMNAME)*, revision C37.232-2011 or later.

R11-A The **ISO** must provide to the **WECC** or the **NERC** upon written request, all sequence of events recording and **fault** recording data that the **ISO** subsequently receives, through making the same request of responsible entities in Alberta, in accordance with requirement R11, within 60 **days** of a request unless an extension is granted by the either the **WECC** or the **NERC**.

R12 Each **legal owner** of a **transmission facility**, **legal owner** of a **generating unit**, and **legal owner** of an **aggregated generating facility** must, within 90 **days** of the discovery of a failure of the recording capability for the sequence of events recording, **fault** recording or dynamic **disturbance** recording data, either:

(a) restore the recording capability, or

(b) submit a corrective action plan to the **ISO** and implement it.

R12.1 the **ISO** must submit a corrective action plan to the **WECC** within 15 **days** of receiving a corrective action plan from any of a **legal owner** of a **transmission facility**, **legal owner** of a **generating unit**, or **legal owner** of an **aggregated generating facility**.

4. Measures

The following measures correspond to the requirements identified in section 3 of this **reliability standard**. For example, MR1 is the measure for requirement R1.

MR1 Evidence of identifying **bulk electric system** buses, notifying **legal owners**, re-evaluating all **bulk electric system** buses, and implementing the re-evaluated list as required in requirement R1 exists. Evidence may include lists, dated correspondence, or other equivalent evidence.

MR2 Evidence of having sequence of events recording data for circuit breaker positions as required in requirement R2 exists. Evidence may include documents describing the device interconnections and configurations which may include a single design standard as representative for common installations, station drawings, and data recordings, or other equivalent evidence.

MR3 Evidence of having **fault** recording data as required in requirement R3 exists. Evidence may include documents describing the device specifications and configurations which may include a single design standard as representative for common installations, station drawings, and data recordings, or other equivalent evidence.

MR4 Evidence of having **fault** recording data as required in requirement R4 exists. Evidence may include data recordings, technical specification sheets, settings documentation, or other equivalent evidence.

MR5 Evidence of identifying **system elements** on the **bulk electric system**, identifying a minimum dynamic **disturbance** recording coverage, and notifying all **legal owners** of identified **system elements** on the **bulk electric system** as required in requirement R5 exists. Evidence may include lists and related documentation, dated correspondence, or other equivalent evidence.

MR6 Evidence of having dynamic **disturbance** recording data as required in requirement R6 exists. Evidence may include data records, documents describing the device specifications and configurations, which may include a single design standard as representative for common installations, station drawings, or other equivalent evidence.

MR7 Evidence of having dynamic **disturbance** recording data as required in requirement R7 exists. Evidence may include data records, documents describing the device specifications and configurations, which may include a single design standard as representative for common installations, station drawings, or other equivalent evidence.

MR8 Evidence of having continuous data recording and storage, or of having triggered records that meet the criteria required in requirement R8 exists. Evidence may include data recordings, technical specification sheets, settings documentation, or other equivalent evidence.

MR9 Evidence of having dynamic **disturbance** recording data as required in requirement R9 exists. Evidence may include data recordings, technical specification sheets, settings documentation or other equivalent evidence.

MR10 Evidence of time synchronizing all sequence of events recording and **fault** recording data, and dynamic **disturbance** recording data as required in requirement R10 exists. Evidence may include technical specification sheets, settings documentation, or other equivalent evidence.

MR11 Evidence of providing all sequence of events recording and **fault** recording data as required in requirement R11 exists. Evidence may include dated correspondence, documents describing data storage capability, device specification, configuration or settings, data records, or other equivalent evidence.

MR11-A Evidence of providing all sequence of events recording and **fault** recording data as required in requirement R11-A exists. Evidence may include dated correspondence, or other equivalent evidence.

MR12 Evidence of either restoring the recording capability or submitting a corrective action plan and implementing it as required in requirement R12 exists. Evidence may include dated reports of discovery of a failure, documentation noting the date the data recording was restored, SCADA records, work orders, dated correspondence, a corrective action plan, or other equivalent evidence.

MR12.1 Evidence of submitting a corrective action plan to the **WECC** as required in requirement R12.1 exists. Evidence may include dated correspondence, or other equivalent evidence.

5. Appendices

Appendix 1 - *Methodology for Selecting Bulk Electric System Buses for Capturing Sequence of Events Recording and Fault Recording Data*

Appendix 2 - *Implementation Plan*

Appendix 3 - *Sequence of Events Recording Data Format*

Revision History

Date	Description
xxxx-xx-xx	Initial release.

Appendix 1

Methodology for Selecting Bulk Electric System Buses for Capturing Sequence of Events Recording and Fault Recording Data

(Requirement R1)

To identify monitored **bulk electric system** buses for sequence of events recording and **fault** recording data required by requirement R1, each **legal owner** of a **transmission facility** must follow sequentially, unless otherwise noted, the steps listed below:

Step 1 Determine a complete list of **bulk electric system** buses that it owns.

For the purposes of this **reliability standard**, a single **bulk electric system** bus includes physical buses with breakers connected at the same voltage level within the same physical location sharing a common ground grid. These buses may be modeled or represented by a single node in **fault** studies. For example, ring bus or breaker-and-a-half bus configurations are considered to be a single bus.

Step 2 Reduce the list to those **bulk electric system** buses that have a maximum available calculated 3-phase short circuit MVA of 1,500 MVA or greater. If there are no buses on the resulting list, proceed to Step 7.

Step 3 Determine the 11 **bulk electric system** buses on the list with the highest maximum available calculated 3-phase short circuit MVA level. If the list has 11 or fewer **bulk electric system** buses, proceed to Step 7.

Step 4 Calculate the median MVA level of the 11 **bulk electric system** buses determined in Step 3.

Step 5 Multiply the median MVA level determined in Step 4 by 20%.

Step 6 Reduce the **bulk electric system** buses on the list to only those that have a maximum available calculated 3-phase short circuit MVA higher than the greater of:

(a) 1,500 MVA; or

(b) 20% of median MVA level determined in Step 5.

Step 7 <u>If there are no **bulk electric system** buses on the list</u>: the procedure is complete and no **fault** recording and sequence of events recording data is required. Proceed to Step 9.

<u>If the list has one or more, but less than or equal to 11 **bulk electric system** buses</u>: **fault** recording and sequence of events recording data is required at the **bulk electric system** bus with the highest maximum available calculated 3-phase short circuit MVA as determined in Step 3. Proceed to Step 9.

<u>If the list has more than 11 **bulk electric system** buses</u>: sequence of events recording and **fault** recording data is required on at least the 10% of the **bulk electric system** buses determined in Step 6 with the highest maximum available calculated 3-phase short circuit MVA. Proceed to Step 8.

Step 8 Sequence of events recording and **fault** recording data is required at additional **bulk electric system** buses on the list determined in Step 6. The aggregate of the number of **bulk electric system** buses determined in Step 7 and in this Step 8 are at least 20% of the **bulk electric system** buses determined in Step 6. The additional **bulk electric system** buses are selected, at the discretion of the **legal owner** of a **transmission facility**, to provide maximum wide-area coverage for sequence of events recording and **fault** recording data. The following **bulk electric system** bus locations are recommended:

(a) electrically distant **bulk electric system** buses or electrically distant from other **disturbance monitoring equipment** devices;

(b) voltage sensitive areas;

(c) cohesive load and generation zones;

(d) **bulk electric system** buses with a relatively high number of incident transmission circuits

(e) **bulk electric system** buses with **reactive power** devices; and

(f) major facilities interconnecting outside the area of the **legal owner** of a **transmission facility**.

Step 9 The list of monitored **bulk electric system** buses for sequence of events recording and **fault** recording data for requirement R1 is the aggregate of the **bulk electric system** buses determined in Steps 7 and 8.

Appendix 2

Implementation Plan

Effective Date

This **reliability standard** is effective on the first **day** 3 full calendar quarters after the date that it is approved by the **Commission**.

Implementation Plan for PRC-002-AB-2 Requirements R1 and R5:

Entities must be 100% compliant on the first **day** following 3 full calendar quarters after the date that the **reliability standard** is approved by the **Commission**.

Implementation Plan for PRC-002-AB-2 Requirements R2, R3, R4, R6, R7, R8, R9, R10,and R11:

Entities must be at least 50% compliant within 4 calendar years of the effective date of PRC-002-AB-2 and 100% compliant within 6 calendar years of the effective date.

Entities that own only one identified **bulk electric system** bus, **system element** on the **bulk electric system**, or **generating unit** must be 100% compliant within 6 calendar years of the effective date.

Entities must be 100% compliant with a re-evaluated list from requirements R1 or R5 within 3 calendar years following the notification by the **ISO** or the **legal owner** of a **transmission facility** that re-evaluated the list.

Standards for Retirement

PRC-018-AB-1

Each **legal owner** of a **transmission facility**, **legal owner** of a **generating unit**, and **legal owner** of an **aggregated generating facility** must maintain documentation to demonstrate compliance with PRC-018-AB-1 until that entity meets the requirements of PRC-002-AB-2 in accordance with this Implementation Plan. **Reliability standard** PRC-018-AB-1 remains effective throughout the phased implementation period of PRC-002-AB-2 and is applicable to an entity's **disturbance** monitoring and reporting activities not yet transitioned to PRC-002-AB-2. PRC-018-AB-1 will be retired following full implementation of PRC-002-AB-2 as noted below.

PRC-018-AB-1 Midnight of the day immediately prior to 6 years after the effective date of PRC-002-AB-2.

Appendix 3

Sequence of Events Recording Data Format

(Requirement R11, R11.3)

Date, Time, Local Time Code, Substation, Device, State[1]

08/27/13, 23:58:57.110, -5, Sub 1, Breaker 1, Close

08/27/13, 23:58:57.082, -5, Sub 2, Breaker 2, Close

08/27/13, 23:58:47.217, -5, Sub 1, Breaker 1, Open

08/27/13, 23:58:47.214, -5, Sub 2, Breaker 2, Open

[1] "OPEN" and "CLOSE" are used as examples. Other terminology such as TRIP, TRIP TO LOCKOUT, RECLOSE, etc. is also acceptable.