

**Compliance Questionnaire and**

**Reliability Standard Audit Worksheet**

**FAC-011-2 — System Operating Limits Methodology for the Operations Horizon**

**Registered Entity:** *(Must be completed by the Compliance Enforcement Authority)*

**NCR Number:** *(Must be completed by the Compliance Enforcement Authority)*

**Applicable Function(s):** RC

**Auditors:**

**Disclaimer**

NERC developed this Reliability Standard Audit Worksheet (RSAW) language in order to facilitate NERC’s and the Regional Entities’ assessment of a registered entity’s compliance with this Reliability Standard. The NERC RSAW language is written to specific versions of each NERC Reliability Standard. Entities using this RSAW should choose the version of the RSAW applicable to the Reliability Standard being assessed. While the information included in this RSAW provides some of the methodology that NERC has elected to use to assess compliance with the requirements of the Reliability Standard, this document should not be treated as a substitute for the Reliability Standard or viewed as additional Reliability Standard requirements. In all cases, the Regional Entity should rely on the language contained in the Reliability Standard itself, and not on the language contained in this RSAW, to determine compliance with the Reliability Standard. NERC’s Reliability Standards can be found on NERC’s website. Additionally, NERC Reliability Standards are updated frequently, and this RSAW may not necessarily be updated with the same frequency. Therefore, it is imperative that entities treat this RSAW as a reference document only, and not as a substitute or replacement for the Reliability Standard. It is the responsibility of the registered entity to verify its compliance with the latest approved version of the Reliability Standards, by the applicable governmental authority, relevant to its registration status.

The NERC RSAW language contained within this document provides a non‑exclusive list, for informational purposes only, of examples of the types of evidence a registered entity may produce or may be asked to produce to demonstrate compliance with the Reliability Standard. A registered entity’s adherence to the examples contained within this RSAW does not necessarily constitute compliance with the applicable Reliability Standard, and NERC and the Regional Entity using this RSAW reserves the right to request additional evidence from the registered entity that is not included in this RSAW. Additionally, this RSAW includes excerpts from FERC Orders and other regulatory references. The FERC Order cites are provided for ease of reference only, and this document does not necessarily include all applicable Order provisions. In the event of a discrepancy between FERC Orders, and the language included in this document, FERC Orders shall prevail.

# Subject Matter Experts

Identify your company’s subject matter expert(s) responsible for this Reliability Standard. Include the person's title, organization and the requirement(s) for which they are responsible. Insert additional lines if necessary.

**Response: *(Registered Entity Response Required)***

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| **SME Name** | **Title** | **Organization** | **Requirement** |
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# Reliability Standard Language

**FAC-011-2 — System Operating Limits Methodology for the Operations Horizon**

**Purpose:**

To ensure that System Operating Limits (SOLs) used in the reliable operation of the Bulk Electric System (BES) are determined based on an established methodology or methodologies.

**Applicability:**

Reliability Coordinator

**NERC BOT Approval Date: 6/24/2008**

**FERC Approval Date: 3/19/2009**

**Reliability Standard Enforcement Date in the United States: 4/29/2009**

**Requirements**:

1. The Reliability Coordinator shall have a documented methodology for use in developing SOLs (SOL Methodology) within its Reliability Coordinator Area. This SOL Methodology shall:
   1. Be applicable for developing SOLs used in the operations horizon.
   2. State that SOLs shall not exceed associated Facility Ratings.
   3. Include a description of how to identify the subset of SOLs that qualify as IROLs.

**Describe, in narrative form, how you meet compliance with this requirement: *(Registered Entity Response Required)***

# R1 Supporting Evidence and Documentation

**Response: *(Registered Entity Response Required)***

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|  | **Provide the following:**  **Document Title and/or File Name, Page and Section, Date and Version** | | |
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| ***Audit Team: Additional Evidence Reviewed:*** | |  |  | |
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***This section must be completed by the Compliance Enforcement Authority.***

**Compliance Assessment Approach Specific to FAC‑011-2 R1**

\_\_\_ Verify the Reliability Coordinator has a documented methodology for use in

developing SOLs (SOL Methodology) within its Reliability Coordinator Area. This

SOL Methodology should:

\_\_\_ Be applicable for developing SOLs used in the operations horizon

\_\_\_ State that SOLs shall not exceed associated Facility Ratings

\_\_\_ Include a description of how to identify the subset of SOLs that qualify as

IROLs

**Auditors Detailed Notes:**

1. The Reliability Coordinator’s SOL Methodology shall include a requirement that SOLs provide BES performance consistent with the following:
   1. In the pre-contingency state, the BES shall demonstrate transient, dynamic and voltage stability; all Facilities shall be within their Facility Ratings and within their thermal, voltage and stability limits. In the determination of SOLs, the BES condition used shall reflect current or expected system conditions and shall reflect changes to system topology such as Facility outages.
   2. Following the single Contingencies[[1]](#footnote-1) identified in Requirement 2.2.1 through Requirement 2.2.3, the system shall demonstrate transient, dynamic and voltage stability; all Facilities shall be operating within their Facility Ratings and within their thermal, voltage and stability limits; and Cascading or uncontrolled separation shall not occur.
      1. Single line to ground or 3-phase Fault (whichever is more severe), with Normal Clearing, on any Faulted generator, line, transformer, or shunt device.
      2. Loss of any generator, line, transformer, or shunt device without a Fault.
      3. Single pole block, with Normal Clearing, in a monopolar or bipolar high voltage direct current system.
   3. In determining the system’s response to a single Contingency, the following shall be acceptable:
      1. Planned or controlled interruption of electric supply to radial customers or some local network customers connected to or supplied by the Faulted Facility or by the affected area.
      2. Interruption of other network customers, only if the system has already been adjusted, or is being adjusted, following at least one prior outage, or, if the real-time operating conditions are more adverse than anticipated in the corresponding studies, e.g., load greater than studied.
      3. System reconfiguration through manual or automatic control or protection actions.
   4. To prepare for the next Contingency, system adjustments may be made, including changes to generation, uses of the transmission system, and the transmission system topology.

**Describe, in narrative form, how you meet compliance with this requirement: *(Registered Entity Response Required)***

# R2 Supporting Evidence and Documentation

**Response: *(Registered Entity Response Required)***

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***This section must be completed by the Compliance Enforcement Authority.***

**Compliance Assessment Approach Specific to FAC‑011‑2 R2**

\_\_\_Verify the Reliability Coordinator's SOL Methodology included a requirement that SOLs provide BES performance consistent with:

\_\_\_In the pre‑contingency state and with all Facilities in service, the BES shall demonstrate transient stability, dynamic stability and voltage stability;

\_\_\_ All Facilities shall be within their Facility Ratings

\_\_\_ All Facilities shall be within their thermal, voltage and stability limits.

\_\_\_Verify in the determination of SOLs, the BES condition used reflected expected system conditions and reflected changes to system topology such as Facility outages.

**\_\_\_** Following the single Contingencies identified in Requirement 2.2.1 through Requirement 2.2.3, the system shall demonstrate transient stability dynamic and voltage stability

\_\_\_ All Facilities shall be within their Facility Ratings

\_\_\_ All Facilities shall be within their thermal, voltage and stability limits.

\_\_\_Verify Cascading Outages or uncontrolled separation shall not occur.

\_\_\_Single line to ground or three‑phase Fault (whichever is more severe), with Normal Clearing, on any Faulted generator, line, transformer, or shunt device.

\_\_\_Loss of any generator, line, transformer, or shunt device without a Fault.

\_\_\_Single pole block, with Normal Clearing, in a monopolar or bipolar high voltage direct current system

Note: Starting with all Facilities in service, the system’s response to a single Contingency may include any of the following:

\_\_\_Planned or controlled interruption of electric supply to radial customers or some local network customers connected to or supplied by the Faulted Facility or by the affected area.

\_\_\_ System reconfiguration through manual or automatic control or protection actions

\_\_\_To prepare for the next Contingency, system adjustments may be made, including changes to generation, uses of the transmission system, and the transmission system topology

\_\_\_Starting with all facilities in service and following any of the multiple Contingencies identified in Reliability Standard TPL‑003, the system shall demonstrate transient, dynamic and voltage stability; all Facilities shall be operating within their Facility Ratings and within their thermal, voltage and stability limits.

\_\_\_Verify Cascading or uncontrolled separation shall not occur

Note: In determining the system’s response to any of the multiple Contingencies, identified in Reliability Standard TPL‑003, in addition to the actions identified in R2.3.1 and R2.3.2, the following shall be acceptable:

\_\_\_Planned or 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) electric power Transfers.

**Auditors Detailed Notes:**

1. The Reliability Coordinator’s methodology for determining SOLs, shall include, as a minimum, a description of the following, along with any reliability margins applied for each:
   1. Study model (must include at least the entire Reliability Coordinator Area as well as the critical modeling details from other Reliability Coordinator Areas that would impact the Facility or Facilities under study.)
   2. Selection of applicable Contingencies
   3. A process for determining which of the stability limits associated with the list of multiple contingencies (provided by the Planning Authority in accordance with FAC-014 Requirement 6) are applicable for use in the operating horizon given the actual or expected system conditions.
      1. This process shall address the need to modify these limits, to modify the list of limits, and to modify the list of associated multiple contingencies.
   4. Level of detail of system models used to determine SOLs.
   5. Allowed uses of Special Protection Systems or Remedial Action Plans.
   6. Anticipated transmission system configuration, generation dispatch and Load level
   7. Criteria for determining when violating a SOL qualifies as an Interconnection Reliability Operating Limit (IROL) and criteria for developing any associated IROL Tv.

**Describe, in narrative form, how you meet compliance with this requirement: *(Registered Entity Response Required)***

# R3 Supporting Evidence and Documentation

**Response: *(Registered Entity Response Required)***

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***This section must be completed by the Compliance Enforcement Authority.***

**Compliance Assessment Approach Specific to FAC‑011-2 R3**

Verify the RC’s methodology for determining SOLs, includes, as a minimum, a description of the following, along with any reliability margins applied for each:

Study model (includes at least the entire RC area as well as critical modeling details

from other RC Areas that would impact the Facility or Facilities under study

Selection of applicable Contingencies

A process for determining which of the stability limits associated with the list of

multiple contingencies (provided by the Planning Authority in accordance with FAC-

014 Requirement 6) are applicable for use in the operating horizon given the actual or

expected system conditions. Does the process address the need to modify limits, the

list of limits, and the list of associated multiple contingencies.

Level of detail of system models used to determine SOLs.

Allowed uses of Special Protection Systems or Remedial Action Plans

Anticipated transmission system configuration, generation dispatch and Load level

Criteria for determining when violating a SOL qualifies as and IROL and criteria for

developing any associated IROL Tv

**Auditors Detailed Notes:**

1. The Reliability Coordinator shall issue its SOL Methodology and any changes to that methodology, prior to the effectiveness of the Methodology or of a change to the Methodology, to all of the following:
   1. Each adjacent Reliability Coordinator and each Reliability Coordinator that indicated it has a reliability-related need for the methodology.
   2. Each Planning Authority and Transmission Planner that models any portion of the Reliability Coordinator’s Reliability Coordinator Area.
   3. Each Transmission Operator that operates in the Reliability Coordinator Area.

**Describe, in narrative form, how you meet compliance with this requirement: *(Registered Entity Response Required)***

# R4 Supporting Evidence and Documentation

**Response: *(Registered Entity Response Required)***

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| ***Audit Team: Additional Evidence Reviewed:*** | |  |  | |
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***This section must be completed by the Compliance Enforcement Authority.***

**Compliance Assessment Approach Specific to FAC‑011-2 R4**

\_\_\_ Verify, the Reliability Coordinator issued its SOL Methodology and any changes to that methodology, prior to the effectiveness of the Methodology or of a change to the Methodology, to all of the following:

\_\_\_ Each adjacent Reliability Coordinator and each Reliability Coordinator that indicated it

has a reliability-related need for the methodology

\_\_\_ Each Planning Authority and Transmission Planner that models any portion of the

Reliability Coordinator’s Area

\_\_\_ Each Transmission Operator that operates in the Reliability Coordinator Area

**Auditors Detailed Notes:**

1. If a recipient of the SOL Methodology provides documented technical comments on the methodology, the Reliability Coordinator shall provide a documented response to that recipient within 45 calendar days of receipt of those comments. The response shall indicate whether a change will be made to the SOL Methodology and, if no change will be made to that SOL Methodology, the reason why.

(Retirement approved by FERC effective January 21, 2014.)

# Supplemental Information

If necessary, provide additional information here that demonstrates compliance with this Reliability Standard. The questions above, if any, may not be all inclusive of evidence required to show compliance. Additional narrative may be provided which displays evidence of compliance with this Reliability Standard.

**Entity** **Response: *(Registered Entity Response)***

# Compliance Findings Summary (to be filled out by auditor)

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| **Req.** | **NF** | **PV** | **OEA** | **NA** | **Statement** |
| **1** |  |  |  |  |  |
| **2** |  |  |  |  |  |
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| **4** |  |  |  |  |  |
| **5** | (Retirement approved by FERC effective January 21, 2014.) | | | | |

**Excerpts from FERC Orders -- For Reference Purposes Only**

**Updated Through March 31, 2009**

**FAC-011-1**

**Order 705**

P 58. … the FAC Reliability Standards explicitly reference shunt devices as one of the contingencies to be examined in setting SOLs, whereas the TPL Reliability Standards do not explicitly reference shunt devises. … we will accept Requirement R2.2 of FAC-010-1 and Requirement R2.2 of FAC-011-1. …

P 69. The Commission does not find that NERC’s interpretation is required by the text of FAC-011-1, Requirement R2.3.2. When read in connection with Requirement R2.3, it is clear that the operating conditions “more adverse than anticipated,” referred to in sub-Requirement R2.3.2 are exacerbating circumstances that are distinct from the actual contingency to be addressed that is referred to in Requirement R2.3. It is the existence of the exacerbating circumstance in combination with a separate and distinct contingency that triggers the potential for an interruption of network customers in R2.3.2. However, that reading does not support treating “load greater than studied” as a contingency.

P 70. … Therefore, keeping with our approach in this Final Rule, we approve FAC-011-1 …

P 77. SOLs are also used by transmission providers to provide details to system users concerning available capacity for transmission service and to communicate justifications for denials of service requests, including long-term ATC. Transmission owners are required to make long-term TTC calculations in accordance with Order Nos. 890 and 693.

P 79. … The FAC-011-1 methodology already requires the reliability coordinator to determine SOLs by considering both the multiple contingencies provided by the planning authority that could result in instability of the Bulk-Power System and the facility outages and minimum set of single contingencies that were previously considered. Requirements R3.3 and R4 direct each reliability coordinator to determine which stability limits arising from multiple contingencies it will apply and convey that information to other reliability coordinators, planning authorities and transmission operators. The list of multiple contingencies is supplied by the planning authority and is applicable for use in the operating horizon given the actual or expected system conditions. This is consistent with the Commission’s directives in Order No.693. …

P 83. The Commission agrees that it is appropriate in this instance to adopt NERC’s revised effective dates of July 1, 2008 for FAC-010-1, October 1, 2008 for FAC-011-1 and January 1, 2009 for FAC-014-1. Given that this Final Rule will not be effective until January 2008, it is reasonable to allow responsible entities in the United States adequate time to comply with these Reliability Standards.

P 84. As for Ontario IESO’s concerns with the different implementation dates in Ontario and the United States, we agree that effective dates should be coordinated if practicable. In these circumstances, however, we foresee no problems arising from the effective dates approved here.

P 163. … As the Commission states previously in this order, FAC-010-1 and FAC-011-1 do not merely establish documentation, methodologies, and administrative tasks, as is the case for the Requirements … The FAC-010-1 and FAC-011-1 Requirements at issue require the Bulk-Power System to demonstrate transient, dynamic, and voltage stability performance pre- and post-contingency. …

**Revision History**

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| --- | --- | --- | --- |
| **Version** | **Date** | **Reviewers** | **Revision Description** |
| 1 | 9/29/09 | QRSAW WG | Created |
| 1.1 | 1/15/10 | R Mountjoy | Revised approval and effective dates |
| 1.2 | 12/2010 | RSAW WG | Revised Findings Table and modified Supporting Evidence Table |
| 1.2 | January 2011 | Craig Struck | Reviewed for format consistency and content. |
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1. The Contingencies identified in FAC-011 R2.2.1 through R2.2.3 are the minimum contingencies that must be studied but are not necessarily the only Contingencies that should be studied. [↑](#footnote-ref-1)