

Standard Development Roadmap

This section is maintained by the drafting team during the development of the standard and will be removed when the standard becomes effective.

Development Steps Completed:

1. SAC approves SAR for posting (March 20, 2002).
2. Drafting Team posts Draft SAR for comment periods (April 2–May 3, 2002) (September 24–October 25, 2002) (December 13–January 31, 2003).
3. SAC approves development of standard (February 27, 2003).
4. JIC assigns development of standard to NERC (March 21, 2003)
5. Drafting team posts drafts for comment (July 1–August 29, 2003) (December 1–January 21, 2004) (February 18–April 3, 2005).
6. Drafting team posts Implementation Plan for comment (June 1–July 15, 2005).
7. Drafting team posts draft for 30-day pre-ballot review (September 1–30, 2005).
8. First ballot conducted October 1–10, 2005 but failed due to lack of quorum.
9. Re-ballot conducted from October 18–November 8, 2005.
10. Drafting team posts revised definition of Contingency for comment (December 1, 2005–January 17, 2006).

Description of Current Draft:

There was no consensus to support the drafting team’s revised definition of ‘Contingency’ and the drafting team has reverted to accepting the definition of contingency that was approved with Version 0 standards. The drafting team is posting FAC-010 for a 30-day, pre-ballot review from February 15 through March 16, 2006.

Future Development Plan:

Anticipated Actions	Anticipated Date
1. Conduct first ballot.	March 20–30, 2006
2. Consider comments submitted with first ballot; post consideration of comments.	April 3–7, 2006
3. Conduct first ballot.	April 10–20, 2006
4. Post standards and implementation plan for 30-day review by board.	April 1, 2006
5. Board adoption date.	May 2, 2006
6. Proposed effective date.	Six months after BOT adoption

Definitions of Terms Used in Standard

This section includes all newly defined or revised terms used in the proposed standard. Terms already defined in the Reliability Standards Glossary of Terms are not repeated here. New or revised definitions listed below become approved when the proposed standard is approved. When the standard becomes effective, these defined terms will be removed from the individual standard and added to the Glossary.

Cascading Outages: The uncontrolled successive loss of Bulk Electric System Facilities triggered by an incident (or condition) at any location resulting in the interruption of electric service that cannot be restrained from spreading beyond a pre-determined area.

Delayed Fault Clearing: Fault clearing consistent with correct operation of a breaker failure protection system and its associated breakers, or of a backup protection system with an intentional time delay.

Interconnection Reliability Operating Limit (IROL): A System Operating Limit that, if violated, could lead to instability, uncontrolled separation, or Cascading Outages that adversely impact the reliability of the Bulk Electric System.

Interconnection Reliability Operating Limit T_v (IROL T_v): The maximum time that an Interconnection Reliability Operating Limit can be violated before the risk to the interconnection or other Reliability Coordinator Area(s) becomes greater than acceptable. Each Interconnection Reliability Operating Limit's T_v shall be less than or equal to 30 minutes.

Normal Clearing: A protection system operates as designed and the fault is cleared in the time normally expected with proper functioning of the installed protection systems.

A. Introduction

1. **Title:** System Operating Limits Methodology
2. **Number:** FAC-010-1
3. **Purpose:** To ensure that System Operating Limits (SOLs) used in the reliable planning and operation of the Bulk Electric System (BES) are determined based on an established methodology or methodologies.
4. **Applicability**
 - 4.1. Reliability Coordinator
 - 4.2. Planning Authority
5. **Proposed Effective Date:** Six months after BOT adoption

B. Requirements

- R1. The Reliability Coordinator shall have a documented methodology for use in developing SOLs (SOL Methodology) within its Reliability Coordinator Area. This SOL Methodology shall:
 - R1.1. Be applicable for developing SOLs used in the operations horizon.
 - R1.2. State that SOLs shall not exceed associated Facility Ratings.
 - R1.3. Include a description of how to identify the subset of SOLs that qualify as IROLs.
- R2. The Planning Authority shall have a documented SOL Methodology for use in developing SOLs within its Planning Authority Area. This SOL Methodology shall:
 - R2.1. Be applicable for developing SOLs used in the planning horizon.
 - R2.2. State that SOLs shall not exceed associated Facility Ratings.
 - R2.3. Include a description of how to identify the subset of SOLs that qualify as IROLs.
- R3. The Reliability Coordinator and Planning Authority shall, by mutual agreement¹, identify and document in their respective SOL Methodologies the planning and operating time horizons addressed in one another's SOL Methodologies.
 - R3.1. The combined horizons shall cover real-time through the end of the planning horizon.
- R4. The Reliability Coordinator's SOL Methodology and the Planning Authority's SOL Methodology shall each include a requirement that SOLs provide BES performance consistent with the following:
 - R4.1. 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.

¹ If mutual agreement cannot be reached, the planning horizon shall be one year and beyond and the operating horizon shall be real-time up to one year.

- R4.2.** Following the single Contingencies² identified in FAC-010 Requirement 4.2.1 through Requirement 4.2.3, 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 Outages or uncontrolled separation shall not occur.
 - R4.2.1.** Single line to ground or 3-phase Fault (whichever is more severe), with Normal Clearing, on any Faulted generator, line, transformer, or shunt device.
 - R4.2.2.** Loss of any generator, line, transformer, or shunt device without a Fault.
 - R4.2.3.** Single pole block, with Normal Clearing, in a monopolar or bipolar high voltage direct current system.
- R4.3.** In determining the system's response to a single Contingency, the following shall be acceptable:
 - R4.3.1.** 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.
 - R4.3.2.** Interruption of other network customers, only if the system has already been adjusted, or is being adjusted, following at least one prior outage³, or, if the real-time operating conditions are more adverse than anticipated in the corresponding studies, e.g., load greater than studied.
 - R4.3.3.** System reconfiguration through manual or automatic control or protection actions.
- R4.4.** 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.
- R4.5.** Following a Regional Reliability Organization identified credible multiple Contingency, the system shall meet criteria established by the Region for that Contingency.
- R5.** The Reliability Coordinator's methodology and the Planning Authority's methodology for determining SOLs, shall include, as a minimum, a description of the following, along with any reliability margins applied for each:
 - R5.1.** Area of study (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.)
 - R5.2.** Selection of applicable Contingencies
 - R5.3.** Level of detail of system models used to determine SOLs

² The Contingencies identified in FAC-010 R4.2.1 through R4.2.3 are the minimum contingencies that must be studied but are not necessarily the only Contingencies that should be studied.

³ An intact system must be able to supply all network customers other than those identified in FAC-010 Requirement 4.3.1 after any single Contingency identified in FAC-010 R4.2. Thus, interruption of such network customers as a response to any single Contingency is not acceptable for a SOL, as developed by a Reliability Coordinator for a system intact condition in the operating horizon or a SOL, as developed by a Planning Authority, for a system intact condition in the planning horizon.

- R5.4.** Allowed uses of Special Protection Systems or Remedial Action Plans
- R5.5.** Anticipated transmission system configuration, generation dispatch and Load level
- R5.6.** Criteria for determining when violating a SOL qualifies as an Interconnection Reliability Operating Limit (IROL) and criteria for developing any associated IROL T_v .
- R6.** The Reliability Coordinator shall issue its SOL Methodology and any changes to that methodology, to all of the following:
 - R6.1.** Each adjacent Reliability Coordinator and each Reliability Coordinator that indicated it has a reliability-related need for the methodology.
 - R6.2.** Each Planning Authority and Transmission Planner that models any portion of the Reliability Coordinator's Reliability Coordinator Area.
 - R6.3.** Each Transmission Operator that operates in the Reliability Coordinator Area.
- R7.** The Planning Authority shall issue its SOL Methodology, and any change to that methodology, to all of the following:
 - R7.1.** Each adjacent Planning Authority and each Planning Authority that indicated it has a reliability-related need for the methodology.
 - R7.2.** Each Reliability Coordinator and Transmission Operator that operates any portion of the Planning Authority's Planning Authority Area.
 - R7.3.** Each Transmission Planner that works in the Planning Authority's Planning Authority Area.
- R8.** The Reliability Coordinator and Planning Authority shall each issue its SOL Methodology and any changes to that methodology to required entities prior to the effectiveness of the change.
- R9.** If a recipient of the SOL Methodology provides documented technical comments on the methodology, the Reliability Coordinator or Planning Authority 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.

C. Measures

- M1.** The Reliability Coordinator and the Planning Authority's SOL Methodology shall each include a statement that Facility Ratings shall not be exceeded and shall address all of the items listed in FAC-010 Requirement 3 through Requirement 5.
- M2.** The Reliability Coordinator shall have evidence it issued its SOL Methodology, and any changes to that methodology, including the date they were issued, in accordance with FAC-010 Requirement 6.
- M3.** The Planning Authority shall have evidence it issued its SOL Methodology and any changes to that methodology, including the date they were issued, in accordance with FAC-010 Requirement 7.
- M4.** If the recipient of the SOL Methodology provides documented comments on its technical review of that SOL methodology, the Reliability Coordinator or Planning Authority that distributed that SOL Methodology shall have evidence that it provided a written response to that commenter 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.

D. Compliance

1. Compliance Monitoring Process

1.1. Compliance Monitoring Responsibility

Regional Reliability Organization

1.2. Compliance Monitoring Period and Reset Time Frame

Each Planning Authority and Reliability Coordinator shall self-certify its compliance to the Compliance Monitor at least once every three years. New Planning Authorities and Reliability Authorities shall each demonstrate compliance through an on-site audit conducted by the Compliance Monitor within the first year that it commences operation. The Compliance Monitor shall also conduct an on-site audit once every nine years and an investigation upon complaint to assess performance.

The Performance-Reset Period shall be twelve months from the last non-compliance.

1.3. Data Retention

The Planning Authority and Reliability Coordinator shall each keep all superseded portions to its SOL Methodology for 12 months beyond the date of the change in that methodology and shall keep all documented comments on its SOL Methodology and associated responses for three years. In addition, entities found non-compliant shall keep information related to the non-compliance until found compliant.

The Compliance Monitor shall keep the last audit and all subsequent compliance records.

1.4. Additional Compliance Information

The Planning Authority and Reliability Coordinator shall each make the following available for inspection during an on-site audit by the Compliance Monitor or within 15 business days of a request as part of an investigation upon complaint:

1.4.1 SOL Methodology.

1.4.2 Documented comments provided by a recipient of the SOL Methodology on its technical review of a SOL Methodology, and the associated responses.

1.4.3 Superseded portions of its SOL Methodology that had been made within the past 12 months.

1.4.4 Evidence that the SOL Methodology and any changes to the methodology that occurred within the past 12 months were issued to all required entities.

2. Levels of Non-Compliance (Does not apply to the Western Interconnection)

2.1. Level 1: There shall be a level one non-compliance if either of the following conditions exists:

2.1.1 The SOL Methodology did not include a statement indicating that Facility Ratings shall not be exceeded.

2.1.2 No evidence of responses to a recipient's comments on the SOL Methodology.

2.2. Level 2: The SOL Methodology did not include a requirement to address all of the elements in FAC-010 R4.

2.3. Level 3: There shall be a level three non-compliance if either of the following conditions exists:

- 1.1.4** The failure of a circuit breaker associated with a Special Protection System to operate when required following: the loss of any element without a Fault; or a permanent phase to ground Fault, with Normal Clearing, on any transmission circuit, transformer or bus section.
- 1.1.5** A non-three phase Fault with Normal Clearing on common mode Contingency of two adjacent circuits on separate towers unless the event frequency is determined to be less than one in thirty years.
- 1.1.6** A common mode outage of two generating units connected to the same switchyard, not otherwise addressed by FAC-010.
- 1.1.7** The loss of multiple bus sections as a result of failure or delayed clearing of a bus tie or bus sectionalizing breaker to clear a permanent Phase to Ground Fault.
- 1.2.** SOLs shall be established such that for multiple Facility Contingencies in FAC-010 E1.1.1 through FAC-010 E1.1.5 operation within the SOL shall provide system performance consistent with the following:
 - 1.2.1** All Facilities are operating within their applicable Post-Contingency thermal, frequency and voltage limits.
 - 1.2.2** Cascading Outages do not occur.
 - 1.2.3** Uncontrolled separation of the system does not occur.
 - 1.2.4** The system demonstrates transient, dynamic and voltage stability.
 - 1.2.5** 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) electric power transfers may be necessary to maintain the overall security of the interconnected transmission systems.
 - 1.2.6** Interruption of firm transfer, Load or system reconfiguration is permitted through manual or automatic control or protection actions.
 - 1.2.7** To prepare for the next Contingency, system adjustments are permitted, including changes to generation, Load and the transmission system topology when determining limits.
- 1.3.** SOLs shall be established such that for multiple Facility Contingencies in FAC-010 E1.1.6 through FAC-010 E1.1.7 operation within the SOL shall provide system performance consistent with the following with respect to impacts on other systems:
 - 1.3.1** Cascading Outages do not occur.
- 1.4.** The Western Interconnection may make changes (performance category adjustments) to the Contingencies required to be studied and/or the required responses to Contingencies for specific facilities based on actual system performance and robust design. Such changes will apply in determining SOLs.

Version History

Version	Date	Action	Change Tracking
1	02/03/06	Page 8, Regional Differences, corrected end of sentence from “FAC-008” to “FAC-010.”	03/20/06

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7. Drafting team posts draft for 30-day, pre-ballot review (September 1–30, 2005).
8. First ballot conducted October 1–10, 2005 but failed due to lack of quorum.
9. Re-ballot conducted from October 18–November 8, 2005.
10. Drafting team posts revised definition of Contingency with FAC-010 for comment (December 1, 2005–January 17, 2006) and holds back on balloting FAC-011 until stakeholders review the revised definition.

Description of Current Draft:

There was no consensus to support the drafting team’s revised definition of ‘Contingency’ and the drafting team has reverted to accepting the definition of contingency that was approved with Version 0 standards. The drafting team is posting FAC-011 for a 30-day pre-ballot review from February 15 through March 16, 2006.

Future Development Plan:

Anticipated Actions	Anticipated Date
1. Conduct first ballot.	March 20–30, 2006
2. Consider comments submitted with first ballot; post consideration of comments.	April 3–7, 2006
3. Conduct second ballot.	April 10–20, 2006
4. Post standards and implementation plan for 30-day review by board.	April 1, 2006
5. Board adoption date.	May 2, 2006
6. Proposed effective date.	Eight months after BOT adoption

Definitions of Terms Used in Standard

This section includes all newly defined or revised terms used in the proposed standard. Terms already defined in the Reliability Standards Glossary of Terms are not repeated here. New or revised definitions listed below become approved when the proposed standard is approved. When the standard becomes effective, these defined terms will be removed from the individual standard and added to the Glossary.

None introduced in this standard.

A. Introduction

1. **Title:** Establish and Communicate System Operating Limits
2. **Number:** FAC-011-1
3. **Purpose:** To ensure that System Operating Limits (SOLs) used in the reliable planning and operation of the Bulk Electric System (BES) are determined based on an established methodology or methodologies.
4. **Applicability**
 - 4.1. Reliability Coordinator
 - 4.2. Planning Authority
 - 4.3. Transmission Planner
 - 4.4. Transmission Operator
5. **Proposed Effective Date:** Eight months after BOT adoption

B. Requirements

- R1. The Reliability Coordinator shall ensure that SOLs, including Interconnection Reliability Operating Limits (IROLs), for its Reliability Coordinator Area are established and that the SOLs (including Interconnection Reliability Operating Limits) are consistent with its SOL Methodology.
- R2. The Transmission Operator shall establish SOLs (as directed by its Reliability Coordinator) for its portion of the Reliability Coordinator Area that are consistent with its Reliability Coordinator's SOL Methodology.
- R3. The Planning Authority shall establish SOLs, including IROLs, for its Planning Authority Area that are consistent with its SOL Methodology.
- R4. The Transmission Planner shall establish SOLs, including IROLs, for its Transmission Planning Area that are consistent with its Planning Authority's SOL Methodology.
- R5. The Reliability Coordinator, Planning Authority and Transmission Planner shall each provide its SOLs and IROLs to those entities that have a reliability-related need for those limits and provide a written request that includes a schedule for delivery of those limits as follows:
 - R5.1 The Reliability Coordinator shall provide its SOLs (including the subset of SOLs that are IROLs) to adjacent Reliability Coordinators and Reliability Coordinators who indicate a reliability-related need for those limits, and to the Transmission Operators, Transmission Planners, Transmission Service Providers and Planning Authorities within its Reliability Coordinator Area. For each IROL, the Reliability Coordinator shall provide the following supporting information:
 - R5.1.1 Identification and status of the associated Facility (or group of Facilities) that is (are) critical to the derivation of the IROL.
 - R5.1.2 The value of the IROL and its associated T_v .
 - R5.1.3 The associated Contingency(ies).
 - R5.1.4 The type of limitation represented by the IROL (e.g., voltage collapse, angular stability).

- R5.2** The Transmission Operator shall provide any SOLs it developed to its Reliability Coordinator and to the Transmission Service Providers that share its portion of the Reliability Coordinator Area.
- R5.3** The Planning Authority shall provide its SOLs (including the subset of SOLs that are IROLs) to adjacent Planning Authorities, and to Transmission Planners, Transmission Service Providers, Transmission Operators and Reliability Coordinators that work within its Planning Authority Area.
- R5.4** The Transmission Planner shall provide its SOLs (including the subset of SOLs that are IROLs) to its Planning Authority, Reliability Coordinators, Transmission Operators, and Transmission Service Providers that work within its Transmission Planning Area and to adjacent Transmission Planners.

C. Measures

- M1.** The Reliability Coordinator, Planning Authority, Transmission Operator, and Transmission Planner shall each be able to demonstrate that it developed its SOLs (including the subset of SOLs that are IROLs) consistent with the applicable SOL Methodology.
- M2.** The Reliability Coordinator, Planning Authority, Transmission Operator, and Transmission Planner shall each have evidence that its SOLs (including the subset of SOLs that are IROLs) were supplied in accordance with schedules supplied by the requestors of such SOLs.

D. Compliance

1. Compliance Monitoring Process

1.1. Compliance Monitoring Responsibility

Regional Reliability Organization

1.2. Compliance Monitoring Period and Reset Time Frame

The Reliability Coordinator, Planning Authority, Transmission Operator, and Transmission Planner shall each verify compliance through self-certification submitted to its Compliance Monitor annually. The Compliance Monitor may conduct a targeted audit once in each calendar year (January–December) and an investigation upon a complaint to assess performance.

The Performance-Reset Period shall be twelve months from the last finding of non-compliance.

1.3. Data Retention

The Reliability Coordinator, Planning Authority, Transmission Operator, and Transmission Planner shall each keep documentation for 12 months. In addition, entities found non-compliant shall keep information related to non-compliance until found compliant.

The Compliance Monitor shall keep the last audit and all subsequent compliance records.

1.4. Additional Compliance Information

The Reliability Coordinator, Planning Authority, Transmission Operator, and Transmission Planner shall each make the following available for inspection during a targeted audit by the Compliance Monitor or within 15 business days of a request as part of an investigation upon complaint:

1.4.1 SOL Methodology(ies)

1.4.2 SOLs, including the subset of SOLs that are IROLs and the IROL's supporting information

1.4.3 Evidence that SOLs were distributed

1.4.4 Distribution schedules provided by entities that requested SOLs

2. Levels of Non-Compliance

2.1. Level 1: Not applicable.

2.2. Level 2: Not all SOLs were provided in accordance with their respective schedules.

2.3. Level 3: SOLs provided were not developed consistent with the SOL Methodology.

2.4. Level 4: No SOLs were provided in accordance with their respective schedules.

E. Regional Differences

None identified.

Version History

Version	Date	Action	Change Tracking