

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.

This proposed standard is the Version 0 VAR-001 modified to include a translation of planning measures III.C.M1, III.C.M2 and III.C.M3, which were not included in the approval Version 0 reliability standards because they required further work.

Development Steps Completed:

1. A SAR was posted from December 2, 2004 through January 7, 2005.
2. The SAC appointed a standard drafting team on January 13, 2005.
3. The drafting team posted its response to SAR comments and all other historical comments on April 19, 2005.
4. The drafting team posted Draft 1 of the standard from April 21, 2005 through June 13, 2005.
5. The drafting team has reviewed comments on Draft 1, prepared a consideration of those comments and incorporated conforming changes into Draft 2.
6. The drafting team posted Draft 2 of the standard from October 15 through November 30, 2005.
7. The drafting team has reviewed comments on Draft 2, prepared a consideration of those comments and incorporated conforming changes into Draft 3.

Description of Current Draft:

This is the third draft of the standard to be posted for industry comment from March 1 through April 15, 2006.

Future Development Plan:

Anticipated Actions	Anticipated Date
1. Review comments from industry posting; post consideration of comments.	April 15–May 15, 2006
2. Post standards and implementation plan for 30-day pre-ballot review.	May 15–June 14, 2006
3. Conduct first ballot.	June 19–29, 2006
4. Consider comments submitted with first ballot; post consideration of comments.	July 3–14, 2006
5. Conduct second ballot.	July 15–25, 2006
6. Post standards and implementation plan for 30-day review by board.	July 1–30, 2006
7. Board adoption date.	August 2, 2006
8. 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.

No new definitions are proposed for this standard.

A. Introduction

1. **Title:** Voltage and Reactive Control
2. **Number:** VAR-001-1
3. **Purpose:** To ensure that voltage levels, reactive flows, and reactive resources are monitored, controlled, and maintained within limits in real time to protect equipment and the reliable operation of the Interconnection.
4. **Applicability:**
 - 4.1. Transmission Operators.
 - 4.2. Purchasing-Selling Entities
5. **Proposed Effective Date:** ~~February 1, 2007~~ Six months after BOT adoption.

B. Requirements

- R1. Each Transmission Operator, individually and jointly with other Transmission Operators, shall ensure that formal policies and procedures are developed, maintained, and implemented for monitoring and controlling voltage levels and Mvar flows within their individual areas and with the areas of neighboring Transmission Operators.
- R2. Each Transmission Operator shall acquire sufficient reactive resources within its area to protect the voltage levels under normal and Contingency conditions. This includes the Transmission Operator's share of the reactive requirements of interconnecting transmission circuits.
- R3. The Transmission Operator shall identify aggregated generating units required to comply as a plant rather than as individual generators.
- R4. The Transmission Operator shall specify criteria that ~~exempts generating units~~ from compliance with the requirements defined in ~~R5~~ Requirement 5, and ~~R7~~ Requirement 7.1.
 - R4.1. Each Transmission Operator shall maintain a list of generators in its area that are exempt from following a voltage or Reactive Power schedule.
 - R4.2. For each generator that is on this exemption list, the Transmission Operator shall notify the associated Generator Owner.
- ~~R2. Each Transmission Operator shall acquire sufficient reactive resources within its area to protect the voltage levels under normal and Contingency conditions. This includes the Transmission Operator's share of the reactive requirements of interconnecting transmission circuits.~~
- ~~R3. Each Transmission Operator shall maintain a list of synchronous generators in its area that are exempt from following a voltage or Reactive Power schedule. For each generator that is on this exemption list, the Transmission Operator shall notify the associated Generator Owner.~~
- R5. Each Transmission Operator shall specify a voltage or Reactive Power schedule to be maintained by each non-exempt ~~synchronous~~ generator. The Transmission Operator shall provide the voltage or Reactive Power schedule to the associated Generator Operator, ~~and direct the Generator Operator to comply with the schedule.~~
 - R5.1. If a Transmission Operator identifies a Generator Operator that is not following its assigned voltage or Reactive Power schedule, the Transmission Operator shall notify the Generator Operator that the schedule is not being met and shall obtain reasons for deviation from the schedule.

Standard VAR-001-1 — Voltage and Reactive Control

- R6.** Each Purchasing-Selling Entity shall arrange for (self-provide or purchase) reactive resources to satisfy its reactive requirements identified by its Transmission Service Provider.
- R7.** The Transmission Operator shall know the status of all transmission Reactive Power resources, including the status of voltage regulators and power system stabilizers.
 - R7.1.** When notified of the loss of an automatic voltage regulator control, the Transmission Operator shall direct the Generator Operator to maintain or change either its voltage schedule or its Reactive Power schedule.
- R8.** The Transmission Operator shall be able to operate or direct the operation of devices necessary to regulate transmission voltage and reactive flow.
- R9.** Each Transmission Operator shall operate or direct the operation of capacitive and inductive reactive resources within its area – including reactive generation scheduling; transmission line and reactive resource switching; and, if necessary, load shedding – to maintain system and Interconnection voltages within established limits.
- R10.** Each Transmission Operator shall maintain reactive resources to support its voltage under first Contingency conditions.
 - R10.1.** Each Transmission Operator shall disperse and locate the reactive resources so that the resources can be applied effectively and quickly when Contingencies occur.
- R11.** Each Transmission Operator shall correct IROL or SOL violations resulting from reactive resource deficiencies (IROL violations must be corrected within 30 minutes) and complete the required IROL or SOL violation reporting.
- R12.** After consultation with the Generator Owner regarding necessary step-up transformer tap changes, the Transmission Operator shall provide documentation to the Generator Owner specifying the required tap changes, a timeframe for making the changes, and technical justification for these changes.
- R13.** The Transmission Operator shall direct corrective action, including load reduction, necessary to prevent voltage collapse when reactive resources are insufficient.

C. Measures

- M1.** The Transmission Operator shall have evidence it provided a voltage or Reactive Power schedule ~~that meets the criteria~~ specified in ~~VAR-001 R5-Requirement 5~~ to each Generator Operator it requires to follow such a schedule ~~and followed up with the Generator Operator following any deviation from schedule as specified in Requirement 5.1.~~
- M2.** The Transmission Operator shall have evidence to show that, for each generating unit in its area that is exempt from following a voltage or Reactive Power schedule, the associated Generator Owner was notified of this exemption.
- M3.** The Transmission Operator shall have evidence to show that it issued directives as specified in ~~VAR-001 R-Requirement 7~~.1 when notified by a Generator Operator of the loss of an automatic voltage regulator control.
- M4.** The Transmission Operator shall have evidence that it provided documentation to the Generator Owner when a change was needed to a generating unit's step-up transformer tap change in accordance with VAR-001 ~~R-11~~Requirement 12.

D. Compliance

1. Compliance Monitoring Process

Standard VAR-001-1 — Voltage and Reactive Control

1.1. Compliance Monitoring Responsibility

Regional Reliability Organization.

1.2. Compliance Monitoring Period and Reset Time Frame

One calendar year.

1.3. Data Retention

The Transmission Operator shall retain current and previous version documentation.

1.4. Additional Compliance Information

The Transmission Operator shall demonstrate compliance through self-certification or audit (periodic, as part of targeted monitoring or initiated by complaint or event), as determined by the Compliance Monitor.

2. Levels of Non-Compliance

2.1. **Level 1:** ~~No documentation to show that owners~~ No evidence that exempt Generator Owners were notified of their exemption as specified under R4.2

2.2. **Level 2:** There shall be a level two non-compliance if either of the following conditions exists:

2.2.1 No ~~documentation evidence~~ to show that directives were issued in accordance with ~~VAR-001-R7~~R7.1.

2.2.2 No evidence that documentation was provided to Generator Owner when a change was needed to a generating unit's step-up transformer tap in accordance with ~~VAR-001-R11~~R12.

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

2.3.1 Voltage or Reactive Power schedules do not exist for all generating units required to follow the schedules.

2.3.2 No evidence that contact was made to follow-up with the Generator Operator when voltage or Reactive Power schedules were not met.

2.4. **Level 4:** No evidence voltage or Reactive Power schedules were provided to Generator Owners.

D. Regional Differences

None identified.

Version History

Version	Date	Action	Change Tracking
0	April 1, 2005	Effective Date	New

Standard Development Roadmap

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This proposed standard is a translation of planning measures III.C.M2, III.C.M4, and III.C.M6, which were not included in the approval Version 0 reliability standards because they required further work.

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8. Proposed effective date.	Six months after effective date of VAR-001-1

Definitions of Terms Used in Standard

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No new definitions are proposed for this standard.

A. Introduction

1. **Title:** Generator Operation for Maintaining Network Voltage Schedules
2. **Number:** VAR-002-1
3. **Purpose:** To ensure generators provide reactive and voltage control necessary to ensure voltage levels, reactive flows, and reactive resources are maintained within applicable Facility Ratings to protect equipment and the reliable operation of the Interconnection.
4. **Applicability**
 - 4.1. Generator Operator.
 - 4.2. Generator Owner.
5. **Proposed Effective Date:** ~~August 1, 2007~~ Six months after effective date of VAR-001-1.

B. Requirements

- R1. The Generator Operator shall operate each ~~synchronous-generating unit~~ connected to the interconnected transmission system in the automatic voltage control mode (automatic voltage regulator in service and controlling voltage) unless otherwise approved by the Transmission Operator.
- R2. Unless exempted by the Transmission Operator, each Generator Operator shall maintain the ~~synchronous~~ generator voltage or Reactive Power output (within applicable Facility Ratings¹) as directed by the Transmission Operator.
 - R2.1. When a generator's automatic voltage regulator is out of service, the Generator Operator shall use an alternative method to control the generator voltage and reactive output to meet the voltage or Reactive Power schedule directed by the Transmission Operator.
 - R2.2. When directed to modify voltage output, the Generator Operator shall comply within 5 minutes or provide an explanation of why the schedule cannot be met.
- R3. Each Generator Operator shall notify its associated Transmission Operator as soon as practical, but within 30 minutes of any of the following: ~~If unable to notify the Transmission Operator within 30 minutes, the Generator Operator shall have documentation to support the reasons for not making the notification within 30 minutes.~~
 - R3.1. A status change on any ~~synchronous~~ generator Reactive Power resource, including the status of each automatic voltage regulator and power system stabilizer and the expected duration of the change in status.
 - R3.2. A status change on any other Reactive Power resources under the Generator Operator's control and the expected duration of the change in status.
 - ~~R3.3. A voltage or Reactive Power schedule for a generator is not maintained.~~
- R4. The Generator Owner shall provide the following to its associated Transmission Operator and Transmission Planner within 30 calendar days of a request.

¹ When a Generator is operating in manual control, reactive power capability may change based on stability considerations and this will lead to a change in the associated Facility Ratings.

R4.1. For generator step-up transformers and auxiliary transformers with primary voltages equal to or greater than the generator terminal voltage:

R4.1.1. Tap settings.

R4.1.2. Available fixed tap ranges.

R4.1.3. Impedance data.

R4.1.4. The +/- voltage range with step-change in % for load-tap changing transformers.

R5. After consultation with the Transmission Operator regarding necessary step-up transformer tap changes, the Generator Owner shall ensure that transformer tap positions are changed according to the specifications provided by the Transmission Operator, unless such action would violate safety, an equipment rating, a regulatory requirement, or a statutory requirements.

R5.1. If the Generator Operator can't comply with the Transmission Operator's specifications, the Generator Operator shall notify the Transmission Operator and shall provide the technical justification associated reason.

C. Measures

M1. The Generator Operator shall have evidence to show that it received approval of its associated Transmission Operator any time it failed to operate a synchronous generator in the automatic voltage control mode.

M2. The Generator Operator shall have evidence to show that it controlled its generator voltage and reactive output to meet the voltage or Reactive Power schedule provided by its associated Transmission Operator.

M3. The Generator Operator shall have evidence to show that it responded to the Transmission Operator's directives as identified in Requirement 2.

M4. The Generator Operator shall have evidence it notified its associated Transmission Operator within 30 minutes of any of the changes identified in VAR-002 R3.1 through Requirement 3.R3-3.

M5. The Generator Owner shall have evidence it provided its associated Transmission Operator and Transmission Planner with information on its step-up transformers and auxiliary transformers as required in VAR-002-Requirements 4.1.1 through R4.1.4

M6. The Generator Owner shall have evidence that its step-up transformer taps were modified per the Transmission Operator's documentation as required in VAR-002-Requirement 5.

D. Compliance

1. Compliance Monitoring Process

1.1. Compliance Monitoring Responsibility

Regional Reliability Organization.

1.2. Compliance Monitoring Period and Reset Time Frame

One calendar year.

1.3. Data Retention

The Generator Operator shall maintain evidence needed for ~~VAR-002-Measure 1~~ through ~~M3-Measure 4~~ for ~~a rolling 12-month~~ the current and previous calendar years.

The Generator Owner shall keep its latest version of documentation on its step-up and auxiliary transformers.

The Compliance Monitor shall retain any audit data for three years.

1.4. Additional Compliance Information

The Generator Owner and Generator Operator shall each demonstrate compliance through self-certification or audit (periodic, as part of targeted monitoring or initiated by complaint or event), as determined by the Compliance Monitor.

2. Levels of Non-Compliance for Generator Operator

2.1. Level 1: There shall be a Level 1 non-compliance if any of the following conditions exist:

2.1.1 Failed to comply with the Transmission Operator's directives as identified in R2 for a specific unit within 10 minutes.

~~1.5.1 Failed to meet the voltage or Reactive Power schedule, subsequent to the 30-minute notification period, for an accumulated time of 8 or less unit hours for an individual generator without Transmission Operator approval.~~

~~1.5.2 Operated without automatic voltage regulator control for 8 or less unit hours for an individual generator without Transmission Operator approval.~~

2.1.2 One incident of failing to notify the Transmission Operator within 30 minutes of one of the status changes identified in ~~VAR-002-R3.1~~ through R3.23.

2.2. Level 2: There shall be a Level 2 non-compliance if either of the following conditions exist:

2.2.1 Failed to comply with the Transmission Operator's directives as identified in R2 for a specific unit within 15 minutes.

~~1.6.1 Failed to meet the voltage or Reactive Power schedule, subsequent to the 30-minute notification period, for an accumulated time of more than 8 but less than 16 unit-hours for an individual generator without Transmission Operator approval.~~

~~1.6.2 Operated without automatic voltage regulator control for more than 8 unit hours but less than 16 unit hours for an individual generator without Transmission Operator approval.~~

2.2.2 More than one but less than 5 incidents of failing to notify the Transmission Operator within 30 minutes of one of the status changes identified in VAR-002 R3.1 through R3.32.

2.3. Level 3: There shall be a Level 3 non-compliance if any of the following conditions exist:

2.3.1 Failed to comply with the Transmission Operator's directives as identified in R2 for a specific unit within 20 minutes.

~~1.7.1 Failed to meet the voltage or Reactive Power schedule, subsequent to the 30-minute notification period, for an accumulated time of 16 or more but less than 24 unit-hours for an individual generator without Transmission Operator approval.~~

Standard VAR-002-1 — Generator Operation for Maintaining Network Voltage Schedules

~~1.7.2~~ Operated without automatic voltage regulator control for more than 24 unit hours for an individual generator without Transmission Operator approval.

~~2.3.3.2~~ More than 5 but less than 10 incidents of failing to notify the Transmission Operator within 30 minutes of one of the status changes identified in VAR-002 R3.1 through R3.32.

2.4. Level 4: There shall be a Level 4 non-compliance if any of the following conditions exist:

~~2.4.1~~ Failed to comply with the Transmission Operator's directives as identified in R2 for a specific unit within 25 minutes.

~~1.8.1~~ Failed to meet the voltage or Reactive Power schedule, subsequent to the 30-minute notification period, for an accumulated time of more than 24 unit hours for an individual generator without Transmission Operator approval.

~~1.8.2~~ Operated without automatic voltage regulator control for more than 24 unit hours for an individual generator without Transmission Operator approval.

~~2.4.3.2.4.2~~ Ten or more incidents of failing to notify the Transmission Operator within 30 minutes of one of the status changes identified in VAR-002-R3.1 through R3.32.

3. Levels of Non-Compliance for Generator Owner:

3.1.1 Level One: Not applicable.

3.1.2 Level Two: Documentation of generator step-up transformers and auxiliary transformers with primary voltages equal to or greater than the generator terminal voltage was missing two of the data types identified in VAR-002-R4.1.1 through R4.1.4.

3.1.3 Level Three: No documentation of generator step-up transformers and auxiliary transformers with primary voltages equal to or greater than the generator terminal voltage

3.1.4 Level Four: Did not ensure generating unit step-up transformer settings were changed in compliance with the specifications provided by the Transmission Operator.

E. Regional Differences

None identified.

Version History

Version	Date	Action	Change Tracking