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		<i>Revision Number: 12 Revision Date: April 3, 2012</i>
<i>Contact: ISO Director, Operations Support Service</i>		<i>Approved by: M/LCC Heads Review Due Date: April 3, 2014</i>


**Master/Local Control Center Procedure No. 8  
(M/LCC 8)**

**Coordination of Generator Voltage Regulator and Power System Stabilizer Outages**

<b>1. References .....</b>	<b>2</b>
<b>2. Purpose .....</b>	<b>2</b>
<b>3. Introduction.....</b>	<b>3</b>
<b>4. Definitions .....</b>	<b>3</b>
<b>5. Applicability .....</b>	<b>4</b>
<b>6. Requesting and Approving an AVR, PSS or RCS Outage .....</b>	<b>7</b>
<b>7. Specific Responsibilities .....</b>	<b>10</b>
<b>8. Logging Requirements .....</b>	<b>12</b>
<b>9. Revision History .....</b>	<b>13</b>
<b>10. Attachments.....</b>	<b>14</b>

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## 1. References

ISO New England Inc. Transmission, Markets and Services Tariff, Section 2, Schedule 22, Large Generator Interconnection Procedures

ISO New England Inc. Transmission, Markets and Services Tariff, Section 2, Schedule 23, Small Generator Interconnection Procedures

NERC Reliability Standard TOP-001 - Reliability Responsibilities and Authorities

NERC Reliability Standard TOP-002 - Normal Operations Planning

NERC Reliability Standard TOP-004 - Transmission Operations

NERC Reliability Standard VAR-001 - Voltage and Reactive Control

ISO New England Planning Procedure No. 5 - Guidelines for Conducting and Evaluating Proposed Plan Application Analysis

ISO New England Operating Procedure No. 12 - Voltage and Reactive Control (OP-12)

ISO New England Operating Procedure No. 12 - Voltage and Reactive Control , Appendix B - Voltage & Reactive Schedules and Surveys (OP-12B)


ISO New England Operating Procedure No. 14 - Technical Requirements for Generators, Demand Resources and Asset Related Demands (OP-14)

ISO New England Operating Procedure No. 19 - Transmission Operations (OP-19)

Master/Local Control Center Procedure No. 2 - Abnormal Conditions Alert (M/LCC 2)

## 2. Purpose

This is a procedure for approval/disapproval and coordination of outages for automatic voltage regulators (AVRs), power system stabilizers (PSSs) and reactive control systems (RCSs). It also establishes a procedure for reporting and tracking status of this equipment.

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		<i>Revision Number: 12 Revision Date: April 3, 2012</i>
<i>Contact: ISO Director, Operations Support Service</i>		<i>Approved by: M/LCC Heads Review Due Date: April 3, 2014</i>

### 3. Introduction

ISO New England (ISO) Operating Procedure No. 12 - Voltage and Reactive Control (OP-12) and ISO Operating Procedure No. 14 Technical Requirements for Generators, Demand Resources and Asset Related Demands (OP-14) establish the guidelines to ensure that reliable and desirable voltage levels are maintained on the New England Transmission System. The reliability of the system is dependent upon the automatic operation of Generator reactive controls. If these devices are removed from service, the ability of the power system to respond dynamically to normal power changes, unplanned events and abnormal conditions will be impacted. The ISO Control Room Staff must be notified immediately of any reduction in capability regarding automatic voltage control in order to conduct studies and formulate contingency actions.

### 4. Definitions

#### **Automatic Voltage Regulator (AVR):**


A voltage-regulating device designed to hold a set voltage by comparing the Generator terminal voltage to the reference voltage. The set voltage is maintained by varying the excitation current to the Generator field.

#### **Power System Stabilizer (PSS):**

An electronic control system applied at a Generator that helps to dampen out dynamic oscillations. Such devices, when installed at a Generator, can be an integral component of the Generator ability to respond to dynamic disturbances of the power system.

#### **Reactive Control System (RCS):**

Equipment at a Generating Station that maintains pre or post-contingent voltage or stability, excluding an AVR or PSS, and is required to be in-service for Generator operation. This equipment can include: capacitor banks, Flexible AC Transmission Systems (FACTSs), Static Var Compensators (SVCs), etc. An example of this would be a wind park controller.


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		<b>Revision Number: 12</b> <b>Revision Date: April 3, 2012</b>
<b>Contact: ISO Director, Operations Support Service</b>		<b>Approved by: M/LCC Heads</b> <b>Review Due Date: April 3, 2014</b>

## 5. Applicability

This procedure applies to:

- All Market Participant Generators, which are required to have an AVR and operate it in the automatic voltage regulation mode. Generators exempted from the requirement to have an AVR are listed in Attachment A - Generators Exempted from AVR Requirements.
- All Market Participant Generators required to have a PSS, as determined by and documented in their System Impact Study (SIS). Generators required to have a PSS are listed in Attachment B - Generators Requiring PSS devices in/out of Service.
- All Market Participant Generators required to have a RCS in service are listed in Attachment C – Generators Requiring a Reactive Control System


ISO provides the voltage schedules for major generating stations throughout the New England Reliability Coordinator Area (RCA) to the associated Generator Operator by posting OP-12, Appendix B - Voltage & Reactive Schedules and Surveys on its public Web site. All dynamic reactive resources (e.g., Generators, SVCs, STATCOMs) within the ISO RCA that are under ISO operational control are required to provide voltage support to the system and follow voltage schedules according to OP-12, Appendix B. As system conditions dictate, a dynamic reactive resource may be instructed by ISO or a Local Control Center (LCC) to deviate from OP-12, Appendix B voltage schedules to produce or absorb reactive power. All Generators in the New England RCA (except those that have been exempted) are required to operate the facility with an AVR in the automatic voltage regulation mode, in service and controlling voltage, unless instructed otherwise. Recognizing that certain assets are required to have reactive compensation in service to maintain acceptable pre- or post-contingent voltage and stability, these assets will also be addressed in this procedure. The AVR is expected to control voltage at the Point(s) of Receipt consistent with the range of voltage scheduled by ISO. Generators not listed in OP-12, Appendix B are instructed to follow local voltage schedules in accordance with LCC requirements or Interconnection Agreements. LCCs have operating instructions for each Generator (including voltage schedules). Under normal conditions all Generators are expected to be capable of maintaining scheduled voltage. Generator Operators are expected to maintain these voltage schedules as closely as possible in system operations and to maintain the voltage schedule with the AVR in the automatic voltage control mode, in service and controlling voltage.

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		<b>Revision Number: 12</b> <b>Revision Date: April 3, 2012</b>
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### **Criteria for Exempting Generators from Certain Voltage and Reactive Requirements:**

All Generators within the ISO RCA provide reactive support to the New England transmission system. Neither ISO nor the LCCs exempt any Generators from following voltage schedules developed by ISO or the LCC. However, a relatively small number of Generators within the New England RCA are exempted from the general ISO requirement to operate with an AVR in service and controlling voltage. These Generators are listed in Attachment A to this procedure. A Generator listed in Attachment A either does not have an AVR or does not operate with the AVR in the automatic voltage control mode, in service and controlling voltage. For all such Generators, ISO has reviewed the impact of this and has determined that this status is acceptable from a reliability perspective. For most Generators to be added to the list in Attachment A, the Generator would have to be evaluated and approved under the Proposed Plan Application Process (under Section I.3.9 of the ISO Tariff) and this exemption would need to be supported by reliability studies performed by the ISO System Planning group.


ISO has established preliminary criteria for evaluating whether a Generator may be granted an exemption from the requirement to operate in Automatic Voltage Control Mode (AVR in service and controlling voltage). The application of these criteria may allow for an operational study by the ISO rather than a full Proposed Plan Application Process evaluation. To ensure sufficient voltage control for reliability, ISO reserves the right to determine whether a Generator will be granted an exemption from AVR requirements. A Generator may be evaluated for exemption from AVR requirements without applying through the Proposed Plan Application Process if it meets one of the sets of criteria below. If the ISO determines that a more extensive study is required, the Generator must then apply for an exemption through the Proposed Plan Application Process. Addition to the exemption list does not preclude reevaluation required with changes processed through the Small Generator Interconnection Agreement (SGIA) / Large Generator Interconnection Agreement (LGIA) Schedule 22 and 23 processes, respectively. These exemption criteria do not relieve that resource from adhering to any other ISO operating document or program requirements.

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		<i>Revision Number: 12 Revision Date: April 3, 2012</i>
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### Proposed Plan Application Process Exemption Criteria:

1. The Generator must:
  - Be connected to the transmission system at a voltage level less than 69 kV
  - Have a plant gross output less than 5 MW SCC-W, except a collection of Generators at a single site must have a total gross output less than 10 MW SCC-W.
  
2. The Generator must:
  - Be a Hydro Generator defined as Daily Cycle-Run of River, Weekly Cycle, or Daily Cycle-Pondage as defined in the Capacity, Energy, Loads and Transmission Report
  - Be connected to the transmission system at a voltage level less than 69 kV
  - Have a plant gross output less than 10 MW SCC-W, except a collection of Generators at a single site must have a total gross output less than 20 MW SCC-W
  
3. The Generator must:
  - Be a wind Generator
  - Provide dynamic capability in lieu of AVR as required by Schedule 22 Interconnection Agreements.
  
4. The Generator Owner documents that the facility was never equipped with an AVR and approval is granted to be exempt from the requirement to have an AVR in operation.

Any Generator seeking an exemption must provide to ISO a detailed description of how the plant will be operated in lieu of active AVR control (i.e., in manual control or constant power factor control mode), including the expected reactive capability (lagging and leading) the plant may utilize over the course of daily operation.

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		<i>Revision Number: 12 Revision Date: April 3, 2012</i>
<i>Contact: ISO Director, Operations Support Service</i>		<i>Approved by: M/LCC Heads Review Due Date: April 3, 2014</i>

## 6. Requesting and Approving an AVR, PSS or RCS Outage

### NOTE


AVR mode changes during normal start-up and shutdown of units are expected and need not be reported to ISO.

#### Planned Outages:

The Market Participant Generating Station Operator is responsible for notifying the LCC of any planned maintenance of the AVR, PSS or RCS that reduces the capacity of the equipment or renders the equipment inoperable. The Market Participant Generating Station Operator will submit an outage request for the AVR, PSS or RCS via the ISO Outage Scheduling software. The ISO Outage Coordination staff and the Operations Support Services Real-time Support group are responsible for performing appropriate analysis and for approving or disapproving the outage request with the concurrence of the LCC System Operator. Prior to the start or completion of an approved planned outage of an AVR, PSS or RCS, the Market Participant Generating Station Operator must also contact both the ISO Control Room and the LCC for final review and approval.

#### Emergency or Forced Outages:

The Market Participant Generating Station Operator is responsible for notifying the ISO Control Room Staff of an emergency or forced outage of an AVR, PSS or RCS that reduces the capacity of the equipment or renders the equipment inoperable. The ISO is responsible for notifying the appropriate LCC of the AVR emergency or forced outage. The LCC is required to instruct the Generator with the AVR outage to maintain or change either its voltage schedule or its Reactive Power. If the Generating Station is listed in Appendix C of this procedure, the Generating Station will be immediately taken offline until the outage can be analyzed by the ISO Operations Support Services Real-time Support group. Any outage of an AVR, PSS or RCS shall be logged by the LCC and ISO Control Room Staff. If an AVR or PSS is out of service for more than 30 minutes the ISO Control Room Staff shall create an outage in the ISO Outage Scheduling software. An outage shall be created in the ISO Outage Scheduling software for any reduction in RCS capability. ISO Control Room Staff and the ISO Operations Support Services Real-time Support group (on-call engineer) will perform the necessary analysis to determine what if any corrective actions are required. The ISO Control Room Staff will seek concurrence of the LCC should any corrective actions be required.

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		<b>Revision Number: 12</b> <b>Revision Date: April 3, 2012</b>
<b>Contact: ISO Director, Operations Support Service</b>		<b>Approved by: M/LCC Heads</b> <b>Review Due Date: April 3, 2014</b>

### Criteria for Evaluating the Impact of an AVR, PSS or RCS Outage:

The ISO Operations Support Services Real-time Support group is responsible for performing the appropriate analysis or studies necessary to:


- Evaluate planned maintenance of any AVR, PSS or RCS that will result in the equipment capacity being reduced or being removed from service, to determine whether to approve or disapprove the request for the planned outage, with the concurrence of the LCC System Operator.
- Evaluate planned maintenance of any AVR, PSS or RCS that will result in the equipment capacity being reduced or being removed from service, to determine any plant or system restrictions in the reduced condition.
- Re-evaluate a previously approved planned outage of an AVR, PSS or RCS at the time that the equipment is actually to be taken out of service, taking into account any changes to system conditions since the original evaluation and approval, to determine whether to approve or disapprove the request for the equipment to be taken out of service.

In performing the appropriate analysis or studies in order to determine whether to approve or disapprove the planned outage of an AVR, PSS or RCS or to determine what if any corrective actions are required in the event of an emergency or forced outage of an AVR, PSS or RCS, the criteria considered by the ISO Operations Support Services Real-time Support group includes, but would not necessarily be limited to the following:


- Industry standards and guidelines for reliable system operation provided by NERC (notably, in NERC Reliability Standards TOP-001, TOP-002, TOP-004 and VAR-001) and NPCC.
- ISO requirements for reliable system operations as documented in ISO New England Operating Procedure No. 19 - Transmission Operations (OP-19).
- Impact of the change on the system's voltage performance, reactive reserves and/or stability behavior which may in turn impact system operability and reliability, reduce system transfer limits and degrade network stability performance.

In addition, there are certain situations where the removal from service of an AVR, PSS, or RCS should be avoided, including the following:

- An AVR, PSS, or RCS that is required to be in service should not be removed from service when Master/Local Control Center Procedure No. 2 - Abnormal Conditions Alert (M/LCC 2) is implemented, unless the outage is unavoidable.

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		<b>Revision Number: 12</b> <b>Revision Date: April 3, 2012</b>
<b>Contact: ISO Director, Operations Support Service</b>		<b>Approved by: M/LCC Heads</b> <b>Review Due Date: April 3, 2014</b>


- The simultaneous removal from service of several AVR's, PSS's or RCS's in any one area should be avoided.
- The removal from service of any PSS that is required to be in service (as listed in Attachment B of this procedure) should be avoided.

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		<b>Revision Number: 12</b> <b>Revision Date: April 3, 2012</b>
<b>Contact: ISO Director, Operations Support Service</b>		<b>Approved by: M/LCC Heads</b> <b>Review Due Date: April 3, 2014</b>

## 7. Specific Responsibilities


The following steps outline the specific responsibilities of the Market Participant Generating Station Operator or their designee, the LCC Operator, and the ISO Control Room Staff:

- A. Each Market Participant Generating Station Operator (or designee) is responsible to:
1. Monitor the status of each AVR, PSS or RCS that is required to be in service. If such equipment becomes inoperative unexpectedly, the Generating Station Operator or their designee shall log the status of the device, notify the ISO Control Room Staff immediately, and initiate a request for repairs.
  2. Request ISO Outage Coordination Staff and LCC Operator approval if a planned outage of an AVR, PSS or RCS is required.
  3. Notify the ISO Control Room Staff prior to the start or completion of an approved planned outage of an AVR, PSS or RCS for final review and approval.
  4. Report any AVR, PSS or RCS related Generator real-time operating constraints, such as restricted availability, restricted response rates, or MW or MVAR output limitations to the ISO Control Room Staff and LCC Operator.
  5. Project the expected return to service-time/date and report this information to the ISO Control Room Staff.
  6. Provide updates should the expected return time/date change.
  7. Manually control the Generator exciter to maintain the appropriate voltage schedule.
- B. Each LCC Operator is responsible to:
1. Coordinate with the ISO Outage Coordination Staff, each planned outage for a Generator AVR, PSS or RCS as required by Section 5, above.
  2. Receive notification from ISO Control Room Staff of each AVR, PSS and RCS outage covered by this procedure.
  3. Review each AVR, PSS or RCS related operating restriction and limitation imposed on the Generator and its impact on voltage and reactive control in the applicable LCC area of jurisdiction.
  4. Instruct the Generator with the AVR outage to maintain or change either its voltage schedule or its Reactive Power schedule
  5. Record the outage and instruction in the appropriate LCC log.

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		<b>Revision Number: 12</b> <b>Revision Date: April 3, 2012</b>
<b>Contact: ISO Director, Operations Support Service</b>		<b>Approved by: M/LCC Heads</b> <b>Review Due Date: April 3, 2014</b>

C. ISO Control Room Staff is responsible to:

1. Notify the ISO Operations Support Services Real-time Support group (on-call engineer) immediately if a Generator AVR, PSS or RCS is to be removed from service or is to be returned to service.
2. Approve/disapprove any AVR, PSS or RCS planned outage based upon the ISO Outage Coordination and Technical Studies group analysis during normal and abnormal operating conditions as required in Section 5, above.
3. Develop contingency actions, as appropriate, and alert the appropriate LCC Operator of the contingent actions required to ensure system reliability and voltage control.
4. Notify the appropriate LCC of each AVR, PSS and RCS outage covered by this procedure.
5. Create an application in the outage scheduling software to track each AVR, PSS and outage.


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		<b>Revision Number: 12</b> <b>Revision Date: April 3, 2012</b>
<b>Contact: ISO Director, Operations Support Service</b>		<b>Approved by: M/LCC Heads</b> <b>Review Due Date: April 3, 2014</b>

## 8. Logging Requirements

**NOTE**


All logging, as defined in this Section, shall be retained for a minimum period of 12 rolling months for consistency with NERC and NPCC standards.

- A. Each Market Participant Generating Station Operator (or designee) and the LCC Operator are responsible for logging and tracking the status of each AVR, PSS and RCS.
- B. During normal and abnormal operating conditions, the ISO Control Room Staff shall maintain records of each AVR, PSS and RCS status.

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		<b>Revision Number: 12</b> <b>Revision Date: April 3, 2012</b>
<b>Contact: ISO Director, Operations Support Service</b>		<b>Approved by: M/LCC Heads</b> <b>Review Due Date: April 3, 2014</b>

## 9. Revision History

Rev. No.	Date	Reason
1	06/01/90	
2	09/07/01	
3	09/01/04	Standardize procedure format and incorporate RTO language changes
4	03/24/05	Update to NERC Version 0 Standards
5	5/19/05	Added notification to the ISO Technical Studies group immediately if a generator automatic voltage regulator or power system stabilizer is to be removed from service or is to be returned to service
6	11/16/06	Revised procedure titles and nomenclature as part of the annual review
7	03/16/09	Biennial Review by Procedure Owner; Globally: Replaced Manager, Operations with Director, Operations in Header; Changed Header Review Due Date: from a fixed calendar date to be 24 months from the Revision Date;; Defined the following Terms and their acronyms: ISO New England (ISO), Local Control Center (LCC), System Control And Data Acquisition (SCADA); Minor reformat for consistency: use of dash in between OP & the number (e.g. OP-4); Complete rewrite of Section 6.0; Globally replaced Local Control Center/SCADA Center System Operator with LCC Operator; In steps 7.1.B.,7.2.A and 7.3.C. replaced ISO New England Control Room Staff with ISO Outage Coordination Staff; Step 7.1.C added "...real-time..."; Step 7.2.A added "...planned..."; Step 7.2.B. added "...for planned outages."; Step 7.3.A changed "...Technical Studies..." to "...Real-time Support..."added "...(on-call engineer...)"; Step 7.3.B. added "...planned..." and "...Outage Coordination and..."
8	04/15/10	Biennial review by procedure owner; Added disclaimer to title page footer; Global minor format changes, changed text font to Arial Updated reference section Used acronyms for AVR, PSS, ISO, LCC, etc. as applicable throughout document; Overall objective of changes is to add/clarify language to more clearly and fully express how ISO meets certain NERC VAR-001 Requirements; Clarified language pertaining to the conduct of studies; Added requirement for the ISO System Operations Support group to annually notify the Generator Operators of the generators listed on the confidential M/LCC 8, Attachments A & B that their generators are listed therein; Added description of ISO criteria for exempting generators from Certain Voltage and Reactive Requirements; Added requirement for generators to contact ISO/LCC prior to taking AVR/PSS out of service to request evaluation/approval; Added criteria for evaluating the impact of an AVR or PSS outage;

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		<b>Revision Number: 12</b> <b>Revision Date: April 3, 2012</b>
<b>Contact: ISO Director, Operations Support Service</b>		<b>Approved by: M/LCC Heads</b> <b>Review Due Date: April 3, 2014</b>

Rev. No.	Date	Reason
9	03/24/11	Globally consistently use of "Generator" instead of "generator" or "resource"; Updated the copyright date in Header and replaced page numbers with Page X of Y format; Section 1 re-ordered title sequence and added documents referred to in text; Modified Section 5: in 1 <sup>st</sup> and 2 <sup>nd</sup> bullets deleted "in a confidential Attachment to this procedure"; added a new 2 <sup>nd</sup> paragraph, Added new sub-section to Section 5 titled: "Proposed Plan Application Process Exemption Criteria." including adding AVR exemption language, removed confidential reference for Attachment A, added language regarding 30 minute time for logging AVR/PSS out of service and Removed requirement to notify generators on Attachment A annually Modified Section 5 sub-section "Emergency or Forced Outages" by adding: "Any outage of an AVR or PSS shall be logged by the LCC and ISO Control Room Staff. If an AVR or PSS is out of service for more than 30 minutes the ISO Control Room Staff shall create an outage in the ISO Outage Scheduling software."; Section 7 added new step 7.C.5
10	06/02/11	Section 5 : Removed "Generator of any type"; Section 6: added new sentence to document instruction of LCC by ISO of AVR outage and Generator with the AVR outage by LCC of appropriate voltage schedule or reactive schedule to follow; Global replaced "direct with "instruct", replaced "directed" with "instructed" and replaced "direction" with "Instruction"; Section 7.4: New step to add language to document responsibility of LCC to "Instruct Generator with AVR outage to maintain or change either its voltage schedule or Reactive Power schedule." And renumbered remaining items. Section 7.5 (former step 7.4) Changed Noting notification directed action to "...outage and instruction in..."
11	08/18/11	Updated procedure contact information; added note to Section 6 that acknowledges AVR mode changes during start-up and shutdown do not need reporting
12	04/03/12	Biennial review by procedure owner; Headers, updated copyright date, replaced the "#" with "No." in M/LCC procedure title; 1 <sup>st</sup> page Footer, deleted 2 <sup>nd</sup> paragraph of disclaimer; Section 2 added Reactive Control System (RCS) and modified as required; Globally replaced instances of AVR and/or PSS) with "reactive controls" as appropriate; Section 3 minor grammar changes to clarify information; Globally replaced "...AVR and (or) PSS..." with "...AVR, PSS and (or) RCS..." as applicable; Section 4 added definition for RCS; Section 5 added new 3 <sup>rd</sup> bullet to address use of new Attachment C, deleted 2 <sup>nd</sup> paragraph, modified 3 <sup>rd</sup> paragraph; Section 6 modified title as required to add RCS and use singular in place of plural where possible; Globally made extensive modifications as required to add RCS and information required by the new Attachment C; Section 10 added new Attachment C to list of Attachments

## 10. Attachments

Attachment A - Generators Exempted From AVR Requirements

Attachment B - Generators Requiring PSS devices in/out of Service

Attachment C - Generators Requiring a Reactive Control System