



**ISO New England Operating Procedure No. 12**  
**VOLTAGE AND REACTIVE CONTROL**

Effective Date: May 6, 2005

References:

1. ISO New England Transmission Operating Guides - All Voltage/Reactive Guides
2. ISO New England Operating Procedure No. 4 - Action During a Capacity Deficiency (OP 4)
3. ISO New England Operating Procedure No. 7 - Action in an Emergency (OP 7)
4. ISO New England Operating Procedure No. 14 - Technical Requirements for Generation, Dispatchable and Interruptible Load (OP 14)
5. ISO New England Operating Procedure No. 16 - Transmission System Data (OP 16)
6. ISO New England Operating Procedure No.19 - Transmission Operations (OP 19)
7. Master/ Local Control Center Procedure No. 9 - Operation of the Chester Static VAR Compensator (M/LCC 9)
8. NERC Standard VAR-001- Voltage and Reactive Control

**TABLE OF CONTENTS**

I. INTRODUCTION ..... 3

II. CRITERIA ..... 3

    A. Voltage Schedules and Limits for Generators and Key Transmission Stations ..... 3

    B. Generator Reactive Capabilities, Commitments and Required Reactive Reserves..... 3

III. VOLTAGE/REACTIVE OPERATING PRACTICES ..... 3

    A. Traditional Voltage/Reactive Control ..... 3

    B. Transmission Interface Transfer Limits To Avoid Low Voltage ..... 4

    C. Circuit Switching to Control High Voltage ..... 4

    D. Load Management for Voltage/Reactive Reliability ..... 4

IV. RESPONSIBILITIES ..... 4

    A. Generating and Transmission Stations ..... 4

    B. Local Control Centers ..... 4

    C. ISO NEW ENGLAND..... 5

OP 12 Revision History ..... 5

**APPENDIX**

- A. Voltage/Reactive Documents in the ISO New England Transmission Operating Guides
- B. Voltage and Reactive Survey

## **I. INTRODUCTION**

This procedure provides broad criteria, operating practices and responsibilities to help ensure that desired/reliable voltage and reactive conditions are maintained on the power system. It also includes general actions to control voltage/reactive conditions when deviations from normal occur or are needed to minimize adverse effects during abnormal conditions.

More specific criteria and actions may be required when the measures described in this procedure do not correct the abnormal voltage/reactive conditions. This information is contained in detailed voltage/reactive documents issued as part of the ISO New England Transmission Operating Guides. Whereas these guides are referenced several times throughout this procedure, Appendix A lists the documents and indicates the types of information they contain. To facilitate references to Appendix A, its column numbering and headings are consistent with the format and order of this procedure.

## **II. CRITERIA**

### **A. VOLTAGE SCHEDULES AND LIMITS FOR GENERATORS AND KEY TRANSMISSION STATIONS**

Major generating stations throughout the New England Control Area have specified voltage schedules, which should be maintained as closely as possible in system operations. They should also be used by operators and planners in off-line studies of the power system. During certain conditions at a generating station or on the power system, sustained deviations from voltage schedules may be required/unavoidable and minimum and maximum voltages have been established that can be sustained at generating stations during these infrequent conditions.

In addition to voltage schedules, minimum and maximum voltage limits at several key generating or transmission stations have been established to promote system reliability during adverse voltage/reactive conditions. These reliability concerns can be based on the security of the transmission system or station service supplies to nuclear generators. The key stations and associated voltage limits are detailed in the area Voltage Guides issued as part of the ISO New England Transmission Operating Guides (refer to Appendix A, column 1).

### **B. GENERATOR REACTIVE CAPABILITIES, COMMITMENTS AND REQUIRED REACTIVE RESERVES**

Generator reactive capabilities available to regulate voltages should be employed in system operations and analyses. Data collection methods (see OP 14) have been designed such that these reactive capabilities should be fully available except for occasional times when unique temporary problems occur at a particular generating station.

To promote security of the transmission system during adverse voltage/reactive conditions, required unit commitments and levels of required reactive reserve for generators within certain areas of the New England Control Area and for the Chester SVC have been established. System conditions that warrant the prescribed unit commitments or reactive reserves have also been identified. Details are provided in the ISO New England Transmission Operating Guides (see Appendix A columns 2 and 3).

## **III. VOLTAGE/REACTIVE OPERATING PRACTICES**

### **A. TRADITIONAL VOLTAGE/REACTIVE CONTROL**

Besides the use of generator reactive capabilities, the proper dispatch of shunt capacitors/reactors combined with effective transformer voltage schedules or fixed tap settings are the most traditional means of achieving desired voltages and reactive conditions. Listings of switchable shunt devices installed to support the New England Transmission System (115 kV and above) and guides for switching them can be found in the area Voltage Guides (see Appendix A, column 4).

**B. TRANSMISSION INTERFACE TRANSFER LIMITS TO AVOID LOW VOLTAGE**

In some cases, custom software tools have been developed to calculate voltage based transfer limits for transmission interfaces. These limits ensure acceptable voltage response to contingencies. Appendix A column 5 notes the transmission operating guides that contain voltage based transfer limits for transmission interfaces.

**C. CIRCUIT SWITCHING TO CONTROL HIGH VOLTAGE**

In some areas, transmission circuit switching is a viable option for controlling high voltage/excessive charging conditions. Appendix A column 6 identifies the ISO New England Transmission Operating Guides that provide information for switching circuits in the Boston area to control high voltage.

**D. LOAD MANAGEMENT FOR VOLTAGE/REACTIVE RELIABILITY**

In severe cases of low voltage and/or inadequate reactive reserves, load management actions can be taken. Details on conditions when these actions can/should be used and how they should be implemented are provided in the Voltage Guides (as identified in Appendix A, column 7) and ISO New England Operating Procedures No. 4 and 7.

**IV. RESPONSIBILITIES**

This procedure is based on the principle that voltage control is best achieved when action is taken as close as possible to the affected area. Voltage schedules and other reactive conditions will be supervised by Station, Local Control Center and the ISO New England Operators, each being responsible for an ever expanding area of responsibility. Regardless of who's requesting or directing corrective measures, action must ultimately be taken by Station or Local Control Center Operators depending on who has "hands on" control of the reactive resources.

**A. GENERATING AND TRANSMISSION STATIONS**

Generating and transmission station operators are responsible for maintaining station service and other local voltage requirements and scheduled voltages at levels designated by individual Market Participants. Generating stations are also responsible for maintaining voltage schedules set for the high side of the generator step-up transformers by the Voltage Task Force. Normally, automatic voltage regulation works off the low side of the step-up transformer (generator terminals). Thus, in order to maintain a high side voltage schedule, manual intervention can be required to offset varying power flows through and voltage drops across the step-up transformer.

When unable to maintain scheduled station and local voltages with the means under their control, the generating or transmission station operators must notify their respective Local Control Center operator (and local dispatch authority if appropriate).

**B. LOCAL CONTROL CENTERS**

Local Control Centers are responsible for monitoring and supervising the following conditions within their territories:

- voltage schedules and limits,
- unit MVAR loadings, capabilities and reserves,
- shunt capacitor and reactor dispatches,
- transformer voltage schedules or fixed tap settings,
- synchronous condenser operation (requested via ISO New England by the Local Control Center unless in emergency conditions),
- MVAR flows between the AC system and HVDC facilities,
- Static VAR Compensator operation (must be coordinated with the ISO),
- line switching for voltage/reactive control (must be coordinated with the ISO and, if warranted, with other Local Control Centers),
- the Local Control Centers will notify/ coordinate the need for MW re-dispatch for MVAR requirements with the ISO. The Local Control Centers will not directly re-dispatch MW with generators unless it is an emergency,

- other predefined indicators of voltage/reactive security (e.g. a particular circuit flow, the status of specific units, area load level, etc.).

Local Control Centers are responsible for: 1) detecting and correcting deviations from normal scheduled voltage/reactive operations, 2) responding to notifications by generating or transmission station operators of difficulty in maintaining station or other local voltage or reactive schedules and, 3) responding to ISO requests to assist with inter-Local Control Center or inter-Area problems.

Local Control Centers are authorized to exercise the following actions to correct voltage/reactive difficulties within their territories:

- direct voltage schedules and levels of reactive output and reserve on generators, synchronous condensers and Static VAR Compensators,
- direct the use of shunt capacitors and reactors,
- direct the operation of LTC transformers.

When a Local Control Center is unable to correct a voltage/reactive problem using the above actions or the Local Control Center believes that the problem should be handled on a multi- Local Control Center or inter-Area basis, the Local Control Center will notify the ISO and request assistance.

Before exercising any of the following voltage/reactive control actions, Local Control Centers must notify the ISO and coordinate their implementations:

- line switching,
- load management.

### C. ISO NEW ENGLAND

The ISO is responsible for the general monitoring and supervision of voltage/reactive conditions in the New England Control Area (115 KV and above). If in monitoring the system a problem is detected within a Local Control Center, the ISO will contact the Local Control Center and request action.

When a Local Control Center reports to the ISO that it is not possible to correct a problem at a station or Local Control Center level, the ISO will assume direct responsibility for alleviating the problem. The ISO is authorized to direct, through the appropriate Local Control Center (s), all actions listed in the above Local Control Center section B and in addition any MW re-dispatching.

The ISO is also responsible for monitoring and supervising voltage/reactive operations of inter-Area ties. Problems may be noticed by the ISO or appear in the form of requests from neighboring pools or companies for assistance. The ISO will inform the appropriate Local Control Center (s) of the nature of the problem specifying; the pool or company involved, the location of the undesirable voltage/reactive condition and, general conditions aggravating the difficulty. The ISO is authorized to work with/through the Local Control Centers and use all section B actions and MWh re-dispatching to eliminate the problem.

When abnormal voltage/reactive operating conditions materialize, the ISO may initiate a survey of key system parameters to better assess the nature and expanse of the conditions. Appendix B contains the survey forms that the ISO will use. The forms are broken down based on Local Control Center territories.

### OP 12 REVISION HISTORY

**Document History** (This Document History documents action taken on the equivalent NEPOOL Procedure prior to the RTO Operations Date as well revisions made to the ISO New England Procedure subsequent to the RTO Operations Date.)

Rev. No.	Date	Reason
Rev 1	08/18/98	
Rev 2	02/01/05	Updated to conform to RTO terminology
Rev 3	05/06/05	Update References for NERC Version 0 Standards