



Operating Procedures

ISO New England Operating Procedure No. 17

Load Power Factor Correction

Effective Date: December 8, 2006
Revision No. 5

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References:

ISO New England Operating Procedure No. 5 Generator and Dispatchable Asset Related Demand Maintenance and Outage Scheduling (OP 5)

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

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

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

Local Control Center Instructions:

CONVEX	NONE
MAINE	NONE
NEW HAMPSHIRE	NONE
REMVEC II	NONE
VELCO	NONE

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I. Introduction

Large power transfers on the transmission system and the provision of contingency coverage requires that adequate reactive capacity be maintained on generators to sustain system voltages. Market Participants should not rely so heavily on reactive support from the transmission system that voltages cannot be maintained during stressed system conditions. On the other hand, Market Participants should not over-correct their loads such that reactive power (VARs) is being exported to the transmission system creating high voltages and degrading system stability. To provide for reliable operation, the reactive requirements of the system must be analyzed from a regional standpoint. The analysis must recognize the following:

- 1) Large power transfers within or between pools/areas can significantly increase reactive power (I^2X) losses;
- 2) The loss of 345kV transmission lines can load remaining lines more heavily and significantly increase I^2X losses;
- 3) Outages of major generators not only remove significant reactive sources but can also result in large MW transfers and increased I^2X losses;
- 4) Power transfers can reach a point where not enough VARs can be transmitted to or away from an area to maintain acceptable voltages;
- 5) The system can reach a state where even though voltages appear adequate, most available VAR generation is being used and a contingency might seriously degrade voltages and reactive performance, and may necessitate emergency action;
- 6) During light load periods, line and cable charging may produce voltages so high that circuits must be opened to reduce voltages;
- 7) Insufficient reactive compensation in a single area can impact neighboring areas and affect overall pool operation.

II. Load Power Factor Requirement

This ISO New England Operating Procedure establishes ranges of acceptable load power factors for various areas within the New England Control Area (described in Appendix A) to provide for reliable system reactive performance. The ranges of acceptable load power factors are portrayed as bandwidths of load power factor expressed as a function of load level. For a specific load level, the bandwidth between a pair of limiting curves represents the range of acceptable load power factors. The ranges are determined through loadflow simulations at various load levels. Appendix B contains the methodology for developing the ranges of acceptable load power factors.

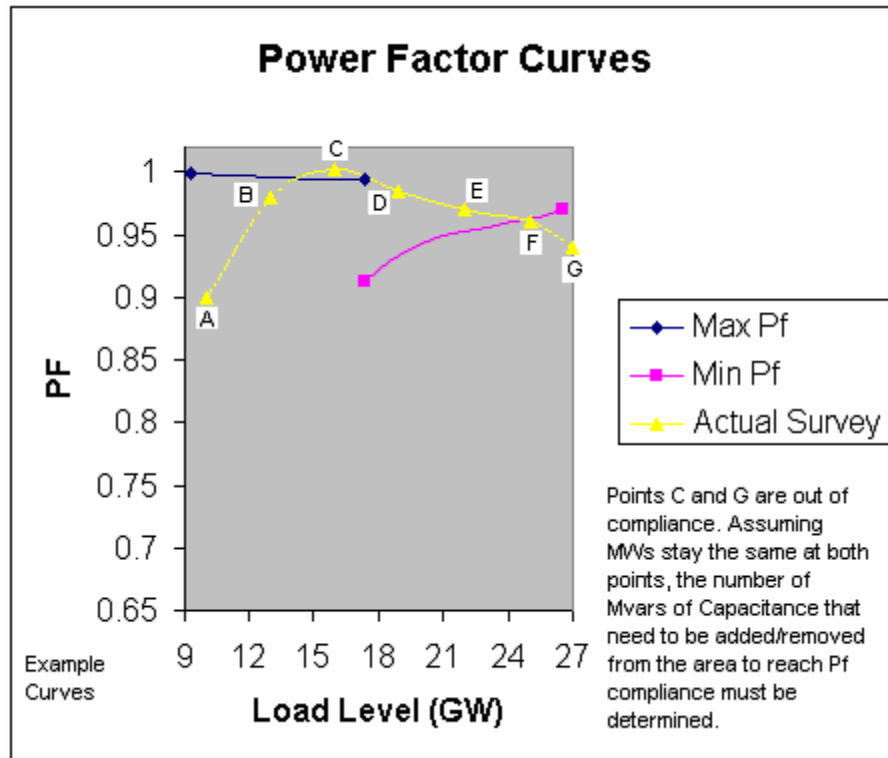
The Transmission Owner has responsibility to monitor the load power factor of all connected distribution loads, as well as add/remove transmission reactive resources to meet the Area voltage requirements. Generating units connected to the bulk power transmission system and sub-transmission system are expected to comply with the voltage schedules in OP 12 (as applicable) and operate according to reactive capability curves provided under OP 14.

The ISO, with Market Participant input through the Voltage Task Force (VTF), will conduct an annual review of the most recently developed curves to determine if they require updating. Factors to be considered are significant changes in the transmission and/or generation system, load growth, etc. If it is determined that the curves require updating, the necessary studies will be undertaken by the ISO or other members of the Voltage Task Force.

III. Survey Procedure and Evaluation

On an annual basis, the ISO Staff will survey the Market Participants to measure compliance with the ranges of acceptable load power factors. For compliance purposes, the audit data will be then compared against curves, which are based on studies representative of the system at the time the audit data is collected. The survey procedure is covered in Appendix C, Instructions for the New England Load Power Factor Survey. By surveying load power factors and comparing them against the ranges, the ISO can determine if load power factors are within reasonable tolerances for reliable operation. In order to give Distribution Providers (DP's) a target of future LPF requirements, a year before the audit, the VTF will update the curves and provide future reactive targets. The survey data also provides the ISO with more accurate data for conducting system studies.

The ISO is charged with the task of evaluating the survey results. The data is aggregated based on Appendix C table 1 and the evaluation is done by plotting the reported load power factor points on a graph displaying the ranges of acceptable load power factors (see Figure 1). If all points for a Market Participant fall within the bandwidth of the curves, the standard has clearly been met. If there are points outside the bandwidth, the ranges of acceptable load power factors have not been met. The degree of noncompliance for each noncompliant point is quantified by identifying the VAR variance from the nearest curve (upper or lower). The largest variance from the lower or minimum allowable load power factor curve represents an amount of shunt capacitance that must be added to achieve compliance. Transmission Owners have the authority to develop and implement actions to achieve compliance. The largest variance from the upper or maximum allowable load power factor curve represents an amount of shunt capacitance that must be switched out, or reactors that must be added to become compliant.

Figure 1: Sample Power Factor Curve and Survey

A summary of the survey results will be presented to the Reliability Committee for appropriate action.

This ISO New England Operating Procedure is intended to complement other ISO New England Operating Procedures. Generator reactive capabilities are submitted under ISO New England Operating Procedure 14 (OP 14) - Technical Requirements for Generation, Demand Resources and Asset Related Demands, Appendix B (Generator Reactive Limits). Voltage and reactive operating constraints are directly addressed in ISO New England Operating Procedure 12 (OP 12) – Voltage and Reactive Control and also considered in the Transmission Criteria of ISO New England Operating Procedure 5 – Generator and Dispatchable Asset Related Demand Maintenance and Outage Scheduling (OP 5) and in granting short term and annual maintenance schedule outages. ISO New England Operating Procedure 19 - Transmission Operation (OP 19) prescribes criteria for the reliable operation of the transmission system including voltage and reactive limitations and contingencies.

OP 17 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	03/07/03	
Rev 2	02/01/05	Updated to conform to RTO terminology
Rev 3	05/06/05	Update for initiation of VELCO Local Control Center
Rev 4	10/01/06	Updated for ASM Phase 2
Rev 5	12/8/06	Update for changes resulting from VTF meetings