Special Protection System
Criteria

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Note:

Terms in bold typeface are defined in the NPCC Glossary of Terms (Document A-7).
1.0 Introduction

1.0.1 This document establishes the protection criteria, and recommends minimum design objectives and practices, for Special Protection Systems. It is not intended to be a design specification. It is a statement of the objectives to be observed when developing design specifications for Special Protection Systems.

1.0.2 These criteria apply to all new Special Protection Systems (SPSs). It is recognized that SPSs existed prior to the establishment of these criteria and the predecessor Guideline. It is the responsibility of individual member systems to assess their existing SPSs and to ensure that modifications are made such that, in their judgment, the intent of these criteria are met. Similar judgment shall be used with respect to an SPS existing at the time of revision to these criteria.

1.0.3 Close coordination must be maintained among system planning, design, operating, maintenance and protection functions, since both initially and throughout their life cycle, SPSs are a multi-discipline concern.

1.0.4 Special Protection Systems are sub-divided into three types. Reference can be made to the NPCC Basic Criteria for Design and Operation of Interconnected Power Systems (Document A-2) where design criteria contingencies are described in Section 5.0; operating criteria contingencies, in Section 6.0; and extreme contingencies, in Section 7.0.

Type I An SPS which recognizes or anticipates abnormal system conditions resulting from design and operating criteria contingencies, and whose misoperation or failure to operate would have a significant adverse impact outside of the local area. The corrective action taken by the SPS along with the actions taken by other protection systems are intended to return power system parameters to a stable and recoverable state.

Type II An SPS which recognizes or anticipates abnormal system conditions resulting from extreme contingencies or other extreme causes, and whose misoperation or failure to operate would have a significant adverse impact outside of the local area. In the application of these systems, their security is the prime concern (see section 2.2 of this document). Since the SPS is installed at the discretion of the member systems,
sections 2.1, 2.6.1, 3.7 and 4.1 of this document do not apply.

Type III An SPS whose misoperation or failure to operate results in no significant adverse impact outside the local area. The practices contained in this document for a Type I SPS should be considered but are not required for a Type III SPS. It should be recognized that a Type III SPS may, due to system changes, become Type I or Type II.

2.0 General Criteria

The general objective for any SPS is to perform its intended function (generator rejection, load rejection, etc.) in a dependable and secure manner. In this context, dependability relates to the degree of certainty that the SPS will operate correctly when required to operate. Security relates to the degree of certainty that the SPS will not operate when not required to operate.

An SPS must recognize or anticipate the specific power system conditions associated with the intended function. The relative effects on the bulk power system of a failure to operate when desired versus an unintended operation must be weighed carefully in selecting design parameters. For example, the choice of duplication as a means of providing redundancy improves the dependability of the SPS but can also jeopardize security in that it may increase the probability of an unintended operation. This general objective can be met only if the SPS can dependably respond to the specific conditions for which it is intended to operate and differentiate these from other conditions for which action must not take place.

2.1 Considerations Affecting Dependability

2.1.1 To enhance dependability, an SPS must be designed with sufficient redundancy such that the SPS is capable of performing its intended function while itself experiencing a single failure. This redundancy is normally provided by duplication. Some aspects of duplication may be achieved by overarming, which is defined as providing for more corrective action than would be necessary if no failures are considered. The redundancy requirements for an SPS apply only with respect to its response to the conditions it is required to detect.

2.1.2 For an SPS which is composed of multiple protection groups, the risk of simultaneous failure of more than one protection group because of design deficiencies or equipment failure shall be considered, particularly if identical equipment is used in each protection group. The extent and nature of these failures shall
be recognized in the design and operation of the SPS.

2.1.3 The design of a Special Protection System which is composed of multiple protection groups for redundancy should avoid the use of components common to the groups. Areas of common exposure should be kept to a minimum to reduce the possibility of all groups being disabled by a single event or condition.

2.2 Considerations Affecting Security

2.2.1 An SPS shall be designed to avoid false operation while itself experiencing any credible failure.

2.2.2 An SPS should be designed to operate only for conditions which require its specific protective or control actions.

2.3 Considerations Common to Dependability and Security

2.3.1 Special Protection Systems should be no more complex than required for any given application.

2.3.2 The components and software used in Special Protection Systems should be of proven quality, as demonstrated either by actual experience or by stringent tests under simulated operating conditions.

2.3.3 The thermal capability of all Special Protection System components must be adequate to withstand the maximum short time and continuous loading conditions to which the associated power system elements may be subjected.

2.3.4 Special Protection Systems should be designed to minimize the possibility of component failure or malfunction due to electrical transients and interference or external effects such as vibration, shock and temperature.

2.3.5 Critical features associated with the operability of Special Protection Systems, e.g. guard signals, critical control switch and test switch positions, and trip circuit integrity, should be annunciated or monitored.

2.3.6 Special Protection System circuitry and physical arrangements should be carefully designed so as to minimize the possibility of incorrect operations due to personnel error.
2.3.7 Special Protection System self-checking facilities should not degrade the performance of the Special Protection System.

2.3.8 Consideration should be given to the consequences of loss of ac voltage inputs to Special Protection Systems.

2.3.9 When remote access to Special Protection Systems is possible, the design should consider the consequences of unauthorized access to the Special Protection Systems on their overall security and dependability.

2.3.10 Consideration should be given to the effect of the means of arming on overall security and dependability of the SPS. Arming shall have a level of security and dependability commensurate with the requirements of the SPS.

2.4 Operating Time

An SPS shall take corrective action within times determined by studies. Adequate time margin should be provided taking into account study inaccuracies, differences in equipment, and protection operating times.

2.5 Arming of an SPS

Arming is the selection, which may be external to the SPS, of desired output action based on power system conditions and recognized contingencies. Arming requirements of an SPS are normally based upon the results of system studies which take into account recognized contingencies, operating policies/procedures and current power system load/generation conditions. For a simple SPS, arming may be an on/off function. An SPS can be armed either automatically or manually.

2.5.1 Automatic arming is implemented without human intervention.

2.5.2 Arming is manual if the recognition, decision or implementation requires human intervention. Sufficient time with adequate margin for recognition, analysis and the taking of corrective action shall be allowed.

2.5.3 An SPS should be equipped with means to enable its arming to be independently verified.

2.6 Special Protection System Testing and Maintenance

2.6.1 Each SPS shall be maintained in accordance with the Maintenance Criteria for Bulk Power System Protection
2.6.2 The design of an SPS both in terms of circuitry and physical arrangement should facilitate periodic testing and maintenance in a manner that mitigates the risk of inadvertent operation. As an SPS may be complex and may interface with other protection systems or control systems, special attention should be placed on ensuring that test devices and test interfaces properly support a clearly defined maintenance strategy.

2.6.3 Test facilities or test procedures shall be designed such that they do not compromise the independence of the redundant design aspects of the SPS.

2.6.4 An SPS shall be functionally tested when initially placed in service and when modifications are made.

2.6.5 If a segmented testing approach is used, test procedures and test facilities shall be designed to ensure that related tests properly overlap. Proper overlap is ensured if each portion of circuitry is seen to perform its intended function, such as operating a relay, from either a real or test stimulus, while observing some common reliable downstream indicator.

2.6.6 All positive combinations of input logic and significant negative combinations must be tested regardless of the maintenance strategy used. Negative combinations of input logic are those for which no SPS action should occur. Significant refers to combinations which could occur based on realistic system conditions and recognized system contingencies.

2.6.7 Sufficient testing shall be employed to ensure that timing races do not exist within hardwired or electronic logic, and that the SPS operating time is within design limits.

2.6.8 Each time the SPS is maintained, its hardware shall be tested in conjunction with the control facilities, related computer equipment, software and operating procedures to ensure compatibility and correct operation.

2.6.9 Whenever practicable, some of the maintenance testing requirements may be met by analyzing and documenting the detailed performance of the SPS during actual events to demonstrate that the specific testing requirements have been fulfilled. Such an approach can reduce the probability of false
operation during maintenance while effectively reducing the extent of planned maintenance.

2.7 Analysis of SPS Performance

2.7.1 **Bulk power system** automatic operations must be analyzed to determine proper **Special Protection System** performance. Corrective measures must be taken promptly if the **Special Protection System** or a **protection group** within the SPS fails to operate or operates incorrectly.

2.7.2 Event recording capability should be provided to the maximum practical extent to permit analysis of system operations and **Special Protection System** performance. It is recommended that these devices be time synchronized.

3.0 Equipment and Design Considerations

3.1 Current Transformers

Current transformers (CTs) associated with **Special Protection Systems** must have adequate steady-state and transient characteristics for their intended function.

3.1.1 The output of each current transformer secondary winding must remain within acceptable limits for the connected burdens under all anticipated currents, including fault currents, to ensure correct operation of the **Special Protection System**.

3.1.2 The thermal and mechanical capabilities of the CT at the operating tap must be adequate to prevent damage under maximum fault conditions and normal or emergency system loading conditions.

3.1.3 For **protection groups** to be independent, they must be supplied from separate current transformer secondary windings.

3.1.4 Interconnected current transformer secondary wiring must be grounded at only one point.
3.2 Voltage Transformers and Potential Devices

Voltage transformers and potential devices associated with Special Protection Systems must have adequate steady-state and transient characteristics for their intended functions.

3.2.1 Voltage transformers and potential devices must have adequate volt-ampere capacity to supply the connected burden while maintaining their relay accuracy over their specified primary voltage range.

3.2.2 If a Special Protection System is designed to have multiple protection groups at a single location for redundancy, each of the protection groups must be supplied from separate voltage sources. The protection groups may be supplied from separate secondary windings on one transformer or potential device, provided all of the following requirements are met:

- Complete loss of voltage does not prevent all operation of the redundant groups;
- Each secondary winding has sufficient capacity to permit fuse protection of the circuit;
- Each secondary winding circuit is adequately fuse protected.

Special attention should be given to the physical properties (e.g. resistance to corrosion, moisture, fatigue) of the fuses used in protection voltage circuits.

3.2.3 The wiring from each voltage transformer secondary winding must not be grounded at more than one point.

3.2.4 Voltage transformer installations should be designed with due regard to ferroresonance.

3.3 Logic Systems

3.3.1 The design should recognize the effects of contact races, spurious operation due to battery grounds, dc transients, radio frequency interference or other such influences.

3.3.2 It should be recognized that timing is often critical in logic schemes. Operating times of different devices vary. Timing differences shall be recognized and accounted for in overall design.
3.4 Microprocessor-Based Equipment and Software

An SPS may incorporate microprocessor-based equipment. Information from this equipment may support other functions such as power system operations. In such cases care should be taken in the design of the software and the interface so that the support of the other functions does not degrade the SPS.

3.5 Batteries and Direct Current (dc) Supply

DC supplies associated with protection must have a high degree of dependability.

3.5.1 If a Special Protection System is designed to have multiple protection groups at a single location for redundancy, no single battery or dc power supply failure shall prevent the independent protection groups from performing the intended function. Each battery must be provided with its own charger.

3.5.2 Each battery should have sufficient capacity to permit operation of the Special Protection System, in the event of a loss of its battery charger or the ac supply source, for the period of time necessary to transfer the load to the other battery or re-establish the supply source.

3.5.3 The circuitry between each battery and its first protective device cannot be protected and therefore must possess a high degree of integrity.

3.5.4 The battery chargers and all dc circuits must be protected against short circuits. All protective devices should be coordinated to minimize the number of dc circuits interrupted.

3.5.5 The regulation of the dc voltage should be such that, under all possible charging and loading conditions, voltage within acceptable limits will be supplied to all devices.

3.5.6 Dc systems shall be monitored to detect abnormal voltage levels (both high and low), dc grounds, and loss of ac to the battery chargers. Protection systems should be monitored to detect abnormal power supply.

3.5.7 Dc systems should be designed to minimize ac ripple and voltage transients.
3.6 **Station Service ac Supply**

If a *Special Protection System* is designed to have multiple *protection groups* at a single location for redundancy, there shall be two sources of station service ac supply, each capable of carrying at least all the critical loads associated with the *Special Protection System*.

3.7 **Circuit Breakers**

3.7.1 Where SPS redundancy is achieved by use of independent *protection groups* tripping the same circuit breakers without overarming, each circuit breaker shall be equipped with two independent trip coils.

3.7.2 If SPS redundancy is achieved by overarming, dual trip coils are not mandatory.

3.7.3 The indication of the circuit breaker position in *Special Protection Systems* should reliably mimic the main contact position.

3.8 **Teleprotection**

Communication facilities required for *teleprotection* must have a level of performance consistent with that required of the *Special Protection System*, such as:

3.8.1 Where the design of a *Special Protection System* is composed of multiple *protection groups* for redundancy and each group requires a communication channel, the equipment and channel for each group should be separated physically and designed to minimize the risk of more than one *protection group* being disabled simultaneously by a single event or condition.

3.8.2 *Teleprotection* equipment should be monitored in order to assess equipment and channel readiness.

3.8.3 *Teleprotection* systems should be designed to assure adequate signal transmission during *bulk power system* disturbances, and should be provided with means to verify proper signal performance.

3.8.4 *Teleprotection* systems should be designed to prevent unwanted operations such as those caused by equipment or personnel.
3.8.5 **Teleprotection** equipment should be powered by the substation batteries or other sources independent from the power system.

3.9 **Control Cables and Wiring and Ancillary Control Devices**

Control cables and wiring and ancillary control devices should be highly dependable and secure. Due consideration should be given to published codes and standards, fire hazards, current-carrying capacity, voltage drop, insulation level, mechanical strength, routing, shielding, grounding and environment.

3.10 **Environment**

3.10.1 Means should be employed to maintain environmental conditions that are favorable to the correct performance of **Special Protection Systems**.

3.10.2 If a **Special Protection System** is designed to have multiple **protection groups** at a single location for redundancy, physical separation should be maintained between the **protection groups** in order to minimize the risk of more than one group being simultaneously disabled by fire or accidents.

3.11 **Grounding**

Station grounding is critical to the correct operation of **Special Protection Systems**. Consideration must be given to station ground grid design, cable shielding and equipment grounding to ensure proper **Special Protection System** operation and to minimize the risk of false operation from **fault** currents or transient voltages.

4.0 **Specific Application Considerations**

4.1 **Provision for Breaker Failure**

A Type I SPS shall include provision for breaker failure for each circuit breaker whose operation is critical to the adequacy of the action taken by the SPS with due regard to the power system conditions this SPS is required to detect. Options for the provision for breaker-failure include:

4.1.1 A design which recognizes that the breaker has not achieved or will not achieve the intended function required by the SPS and which takes independent action to achieve that function. This provision need not be duplicated and can be combined with
conventional breaker failure schemes if appropriate.

4.1.2 Overarming the SPS such that adequate action is taken even if a single breaker fails.

4.1.3 The redundancy afforded by actions taken by other independent schemes or devices.

5.0 Reporting of Special Protection Systems

Each new or modified Special Protection System must be reported to NPCC in accordance with the Procedure for NPCC Review of New or Modified Special Protection Systems (SPS) (Document C-16). In addition, each new or modified Type I or Type II Special Protection System must be reported to the Task Force on System Protection in accordance with the Procedure for Reporting and Reviewing Proposed Protection Systems for the Bulk Power System (Document C-22).

Prepared by: Task Force on System Protection

Review frequency: 3 years

References:
- Basic Criteria for Design and Operation of Interconnected Power Systems (Document A-2)
- Emergency Operation Criteria (Document A-3)
- Maintenance Criteria for Bulk Power System Protection (Document A-4)
- NPCC Glossary of Terms (Document A-7)
- Procedure for NPCC Review of New or Modified Bulk Power System Special Protection Systems (Document C-16)
- Procedure for Reporting and Reviewing Proposed Protection Systems for the Bulk Power System (Document C-22)
Guide for the Application of Autoreclosing to the Bulk Power System

Approved by the System Design Coordinating Committee and the Operating Procedure Coordinating Committee on January 29, 1979.

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Notes:
Terms in bold face type are defined in the NPCC Glossary of Terms (Document A-7). Italicized terms are defined in Section 3.0 of this Guideline.

The terms autoreclosing, high-speed autoreclosing and synchronism-check are defined in the Glossary (Document A-7). These terms are included in the definition list (Section 3.0) of this document for reference only, in order to make the document easier to read.
1.0 Objectives

The purpose of this document is to establish guidelines for the application of autoreclosing facilities to circuit breakers on the NPCC bulk power system. This document is not intended to provide guidance for the operation of the bulk power system in matters of reclosing, such as enabling or disabling autoreclosing or providing for manual closures following automatic tripping of an element.

2.0 Introduction

Autoreclosing should be applied for the purpose of restoring transmission lines to service subsequent to automatic tripping of their associated circuit breakers due to electrical faults. Experience of the NPCC member companies indicates that many faults on the bulk power overhead transmission system are temporary. In the absence of autoreclosing, longer duration outages could be experienced unnecessarily. Successful autoreclosing can enhance stability margins and overall system reliability. However, autoreclosing into a permanent fault may adversely affect system stability, hence due consideration must be given to this aspect of any application.

3.0 Definitions

3.1 Autoreclosing* is the automatic closing of a circuit breaker in order to restore an element to service following automatic tripping of the circuit breaker. Autoreclosing does not include automatic closing of capacitor or reactor circuit breakers.

3.2 Breaker reclosing time is the elapsed time between the energizing of the breaker trip coil and the closing of the breaker contacts to reestablish the circuit by the breaker primary contacts on the reclose stroke.

3.3 High-speed autoreclosing* refers to the autoreclosing of a circuit breaker after a necessary time delay (less than one second) to permit fault arc deionization with due regard to coordination with all relay protective systems. This type of autoreclosing is generally not supervised by voltage magnitude or phase angle.

* See note on Table of Contents Page
3.4 Delayed autoreclosing refers to the autoreclosing of a circuit breaker after a time delay which is intentionally longer than that for high-speed autoreclosing.

3.5 Synchronism-check* refers to the determination that acceptable voltages exist on the two sides of the breaker and the phase angle between them is within a specified limit for a specified time.

3.6 Multiple-shot autoreclosing refers to the autoreclosing of the circuit breaker(s) more than once within a predetermined reclosing sequence.

3.7 Blocking refers to the automatic prevention of an action following specific relay tripping operations.

3.8 Single-pole autoreclosing refers to the autoreclosing of one pole of a circuit breaker following a designed single-pole trip for single-phase-to-ground faults.

3.9 Manual refers to either local or remote switching operations that are initiated by an operator.

3.10 Automatic refers to either local or remote switching operations that are initiated by relay or control action without the direct intervention of an operator.

4.0 Common Considerations to High-Speed and Delayed Autoreclosing

4.1 Blocking of Autoreclosing

Autoreclosing should be blocked during the reception of a transferred trip signal. Autoreclosing should not be initiated following any manual operation of a circuit breaker.

4.2 Turbine-Generator Considerations

Manual closing or autoreclosing at line terminals that are in electrical proximity to turbine-generators may subject them to excessive shaft torques and winding stresses with resultant loss of life of the turbine-generator system. These effects should be studied and evaluated before autoreclosing is applied. It is preferable to re-energize a line at a terminal remote from the generator bus and then close at the generator end.

* See note on Table of Contents Page
4.3 Circuit Breaker Capability

**Autoreclosing** times and sequences should be selected with due regard to circuit breaker interrupting capability, derating, voltage withstand capability, resistor thermal capability, and overall breaker design.

4.4 Number of Operations

Multiple-shot **autoreclosing** systems should be designed considering available air or gas pressure for breaker operation.

4.5 Breaker Failure Operations

**Autoreclosing** following breaker failure operation is generally not recommended until the failed breaker is isolated.

4.6 Other System Elements

Risks versus benefits should be evaluated before applying **autoreclosing** following faults on transformers, busses, or cables. For these system elements, it is generally not advisable to **autoreclose** since the probability of a fault being permanent is high and the probability of aggravating equipment damage is increased. Under specific circumstances, however, the benefits of **autoreclosing** may justify its use.

4.7 Multiple Circuit Breaker Line Termination

The recommended mode of **autoreclosing** at a terminal with more than one breaker per line is to **autoreclose** with a preselected breaker. Following successful **autoreclose** operation, the other breaker(s) associated with the line at that terminal may be **autoreclosed**. Since simultaneous closing times are difficult to achieve, **autoreclosing** into a permanent fault by more than one breaker at the same line terminal could result in the fault being maintained on the system for a longer than intended period and may be followed by an incorrect breaker failure operation. In addition, the severity of the system **disturbance** may be increased.
5.0 **High-Speed Autoreclosing Considerations**

5.1 **Tripping Requirements**

*High-speed autoreclosing* should be initiated only if all terminals of the line are tripped without intentional time delay for line *faults*.

5.2 **Stability Considerations**

When *high-speed autoreclosing* is under consideration as a means for increasing the *transient stability* margin of a system, restoring service to critical *loads*, or restoring needed system interconnections, it should be recognized that there is a risk as well as a possible benefit attending its use. The risk is that *stability* may be endangered rather than benefited if a line is *autoreclosed* into a permanent *fault*. *Stability* studies should indicate whether or not the use of *high-speed autoreclosing* should be restricted.

5.3 **Out-of-Step Conditions**

*High-speed autoreclosing* should be *blocked* following an out-of-step *relay* operation.

5.4 **Switching Surge Considerations**

*High-speed autoreclosing* should not be used where transient voltage analysis studies indicate that *high-speed autoreclosing* may produce switching *surge* magnitudes exceeding the equipment design levels.

6.0 **Delayed Autoreclosing Considerations**

6.1 **General Use**

*Delayed autoreclosing* may be used, following design analysis, when restrictions such as in Section 5.0 exist.
6.2 Frequency, Phase Angle and Voltage Considerations

Synchronism-check relays should be used where analysis shows that for credible system conditions there may be harmful effects on the system due to excessive frequency differences, phase angles, or voltage magnitudes across the closing breaker. When applying synchronism-check relays appropriate consideration should be given to avoiding unnecessary restriction of breaker autoreclosing or manual closing following major system disturbances. It may be necessary to employ means to ensure undesired autoreclosing modes do not take place. For example, dead-line supervision of autoreclosing or manual closing may be used where harmful effects on the system would result from connection of energized facilities.

6.3 Autoreclosing Time Considerations

A time delay should be used, as determined by stability studies, to allow damping of system oscillations following a disturbance. If stability studies are not available, a 15-second time delay appears to be conservative for most systems.

Following the initiation of an autoreclosing sequence, autoreclosing attempts should be prevented after a predetermined time period. This time period should not prohibit completion of the autoreclosing sequence and must include circuit breaker fault clearing time, synchronism-check timing and protective relay and control system response times. To prevent unexpected operation, the autoreclosing sequence must be completed or go to a lockout state prior to the commencement of operator-initiated switching. Re-arming of the autoreclosing scheme may be achieved by automatic, manual or remote methods.
Control Performance Guide

Approved by the System Design Coordinating Committee and the Operating Procedure Coordinating Committee on September 17, 1980

Revised:    July 17, 1984
           July 7, 1987
           October 16, 1991
           May 9, 1995
           March 2, 1999
Note:

Terms in bold typeface are defined in the *NPCC Glossary of Terms* (Document A-7)
1.0 Introduction

The Northeast Power Coordinating Council (NPCC) member systems have adopted the North American Electric Reliability Council Operating Committee (NERC/OC) Policies. These Policies establish basic principles for interconnected operation throughout North America. The NERC/OC has also established Criteria for measuring control performance which NPCC has similarly endorsed. This NPCC Guide shall serve to supplement NERC/OC documents.

2.0 NERC/OC Monitoring Standards

The NERC/OC Monitoring Standards which apply during electric power system operation are:

Control Performance Standard 1 (CPS1)

Over a given period (e.g. 1 year), the average of the clock-minute averages of an Area’s ACE divided by 10 times its bias multiplied by the corresponding clock-minute averages of frequency error shall be less than the targeted frequency bound (ε₁) established by NERC. See NPCC Monitoring Procedures for Control Performance Guide (Document C-8) for calculation details.

Control Performance Standard 2 (CPS2)

The average ACE for each of the six 10-minute periods in an hour must be within that Area’s Allowable Limit of the Average Deviation (L₁₀) calculated from ε₁₀). See Procedure C-8 for calculation details.

Note: ε₁ and ε₁₀ are supplied by NERC.

The NERC/OC and NPCC objective is that each control area meets or exceeds the above CPS1 and CPS2 Standards.

3.0 Basic Principles

3.1 The amount of generation on automatic generation control in each control area at any time should be an amount sufficient to meet NERC/OC Standards.
3.2 Except during significant frequency excursions as provided in the NPCC Emergency Operation Criteria (Document A-3), automatic generation control equipment should remain in service at all possible times to provide immediate response to sudden load changes or loss of generating equipment.

3.3 It is recognized that the cost of control is a necessary expense for reliability of interconnected operation.

4.0 Minimum Facilities

4.1 In determining the area control error, adjacent Areas shall use the same source metering.

4.2 Each Area shall provide the ability to monitor conformance to NERC/OC Criteria and to keep records of control performance in accordance with NPCC Procedure C-8.

5.0 Performance Standard

Satisfactory control performance is achieved if:

* The rolling 12 month average compliance with CPS-1 is greater than or equal to 100%

AND

* The monthly compliance with CPS-2 is greater than or equal to 90%.

The NPCC objective is that these minimum Performance Standards, as established by NERC, will be met or exceeded.

6.0 Performance Reporting

6.1 Each Area will report conformance with CPS1 and CPS2 monthly to the Control Performance Working Group (CPWG).

6.2 The CPWG will report to the Task Force on Coordination of Operation (TFCO) in accordance with Procedure C-8. The TFCO, in turn, will review the report and forward its recommendation on compliance actions along with the report to the Compliance Monitoring and Assessment Subcommittee (CMAS).
Coordinated by:  Task Force on Coordination of Operation

Reviewed for concurrence by:  TFCP and TFSS

Review frequency:  3 years

References:  *Emergency Operation Criteria* (NPCC Document A-3)

*NPCC Glossary of Terms* (NPCC Document A-7)


*NERC Performance Standard Training Document*

*NERC Policy 1 – Generation Control And Performance*
Guidelines for Inter-AREA Voltage Control

Approved by the Operating Procedure Coordinating Committee and the System Design Coordinating Committee on May 27, 1981

Revised: March 15, 1983
May 14, 1985
February 8, 1989
December 8, 1992
November 6, 1997
1.0 Introduction

This guideline provides general principles and guidance for effective inter-Area voltage control, consistent with the NPCC Basic Criteria (NPCC Document A-2) and NERC Policy 2. Specific methods to implement these guidelines may vary among Areas, depending on local requirements. Coordinated inter-Area voltage control is necessary to regulate voltages to protect equipment from damage and prevent voltage collapse. Coordinated voltage regulation reduces electrical losses on the network and lessens equipment wear and tear. Local control actions are generally most effective for voltage regulation. Occasions arise when adjacent Areas can assist each other to compensate for deficiencies or excesses of reactive power and improve voltage profiles and system security.

2.0 Principles

Each Area shall develop, and operate in accordance with, its own voltage control procedures and criteria. Area procedures and criteria shall be consistent with NPCC and NERC Criteria and Guidelines. Adjacent Areas should be familiar with each others criteria and procedures. Areas shall mutually agree upon procedures for inter-Area voltage control. Whether inter-Area voltage control is carried out through specific or general procedures, the following should be considered and applied:

2.1 to effectively coordinate voltage control, location and placement of metering for reactive power resources and voltage controller status must be consistent between adjacent Areas.

2.2 availability of voltage regulating transformers in proximity of tie lines

2.3 voltage levels, limits, and regulation requirements for stations on either side of an inter-Area interface.

2.4 circulation of reactive power (export at one tie point in exchange for import at another).

2.5 tie line reactive losses as a function of real power transfer

2.6 reactive reserve of on-line generators

2.7 shunt reactive device availability and switching strategy.

2.8 static VAR compensator availability, reactive reserve, and control strategy.