

NEPOOL PLANNING PROCEDURE NO. 5-5

**SPECIAL PROTECTION SYSTEMS
APPLICATION GUIDELINES**

APPROVED: June 8, 1999 by the NEPOOL Regional Transmission Planning Committee

REFERENCES:

I. INTRODUCTION

A Special Protection System (SPS) is defined as a protection system designed to detect abnormal system conditions, and take corrective action other than the isolation of faulted elements. Such action may include changes in load, generation, or system configuration to maintain system stability, acceptable voltages or power flows. Automatic underfrequency load shedding as defined in the NPCC *Emergency Operation Criteria* (Document A-3), is not considered an SPS. Conventionally switched, locally controlled shunt devices are not SPSs. (Ref. NPCC Document A-7)

Criteria for design and operation concerning transmission capability for Northeastern North America, including conditions specific to SPSs, are established in the NPCC *Basic Criteria for Design and Operation of Interconnected Power Systems* (Document A-2). Similar design conditions are specified for New England in the NEPOOL *Reliability Standards* (PP-YY). In addition to providing guidelines for the design, testing and operation of SPSs, the NPCC *Special Protection System Guideline* (Document B-11) categorizes SPSs according to the criteria fault for which it is designed and the impact its failure would have on the network.

II. PURPOSE

The above criteria and guidelines focus on the effects of proper and improper operation of SPSs, generally leading to a determination of need for individual SPS security and reliability. They provide no direction regarding situations in which an SPS might be appropriate or inappropriate in its application or functionality, or if particular design choices might result in unacceptable risk or complexity in operations. Such factors are included in these SPS application guidelines.

III. GUIDELINES

Tables I, II and III establish guidelines which constitute generally acceptable conditions for the application of SPSs in New England, corresponding with the three categories of SPSs as defined by NPCC. Each SPS will be evaluated based on these guidelines and consideration of the potential impacts on system operations and reliability. Exceptions to these guidelines may be permitted in limited circumstances, based on an assessment of such factors as the extent of the deviation from the guidelines and the impact of such deviation on any associated reliability or security risk or the complexity of system operations. Conversely, consideration of such factors and alternatives, including upgrading the transmission system, may result in an SPS being judged unacceptable even though it adheres to the guidelines.

NPCC Type I SPS's

- NPCC Type I SPS's are associated with conditions resulting from Normal Criteria events; their failure or misoperation has the potential for significant adverse interarea impact.
- In general, a Type I SPS will not be used to mitigate the impacts of normal contingencies except in the following instances: 1) contingencies involving two adjacent circuits on a multicircuit tower, 2) contingencies whose impacts are confined to a limited local area¹.

even though the area is not wholly within New England, and 3) contingencies with a transmission facility already out of service.

- The conditions of Table I apply

NPCC Type II SPS's

- NPCC Type II SPS's are associated with conditions resulting from Extreme Criteria events; their failure or misoperation has the potential for significant adverse impact outside of the local area.
- A Type II SPS will be considered as an acceptable mitigating measure, subject to the conditions of Table II.

NPCC Type III SPS's

- NPCC Type III SPS's are those that have have potential for local impacts only.
- They are reviewed periodically to determine if, due to system changes, they have become Type I or Type II.
- A Type III SPS may be used, subject to the conditions of Table III.

Notes:

1. For the purpose of these SPS Application Guidelines, "local area" refers to an area comprising no more than 10% of the total New England load. Load external to New England may be treated as if it was within New England if the region the other load is within accepts the SPS and its associated risk. For this condition, NPCC design requirements apply for a Type I SPS; however, the Type III conditions for SPS application may apply depending on the nature and extent of the impact.
2. Parallel equipment which require multiple pickups for similar events are not counted as a separate events. Parameters monitored must all be located at the same station. For example, acceptable detection triggers could be each breaker within a substation or parallel lines between the same terminals; however, overloads measured at different stations would not be considered a single detection trigger.
3. An action is considered complementary if, once an action is taken by one SPS, that action is no longer needed by another SPS.
4. The design limit for resource rejection is 1200 MW, although there may be system conditions for which the operating limit may be higher.

TABLE I

Acceptable Conditions for Type I SPS Application

Number of detection triggers for SPS	1 detection trigger per SPS ²
Number of actions triggered by an SPS	Limited actions within one station
Number of SPS's per action	1 SPS per action unless complementary actions within one station ³
Location of monitoring	Local
Location of action relative to SPS	Local or radial connection
Security & dependability	Per NPCC Document B11, Special Protection System Guideline
Selectivity of triggers	Fixed response with no selectivity by operators. An SPS must not operate for contingencies for which it is not intended to operate.
Arming	Manual with alarms when conditions exist for selection or arming, otherwise automatic
Potential for interaction with other SPS's	Unacceptable except for intentional interaction with a Type III which results in no inter-Area impact. No unintentional interaction is acceptable.
SPS required for dynamic, voltage, or thermal response	Speed of response is adequate to protect against the need
Actions Taken	<ul style="list-style-type: none"> - Insertion of stabilizing devices, load rejection, or generation and/or import rejection⁴ - Load rejection, generation and/or import rejection⁴ - Load rejection, generation and/or import rejection⁴, or operation of transmission device
Exposure to operation	Continuous is acceptable
Permissible life of the SPS	Life of the associated project or until system changes make it unacceptable or unnecessary.
System Operation	An SPS actuation may not result in an unacceptable operating condition or in the increase in the amount of required operating reserve.

TABLE II

Acceptable Conditions for Type II SPS Application

Number of detection triggers for SPS	1 detection trigger per SPS ²
Number of actions triggered by an SPS	Limited actions within one station
Number of SPS's per action	1 SPS per action unless complementary actions within one station ³
Location of monitoring	Local
Location of action relative to SPS	Local or radial connection
Security & dependability	Per NPCC Document B11, Special Protection System Guideline
Selectivity of triggers	Fixed response with no selectivity by operators. An SPS must not operate for contingencies for which it is not intended to operate.
Arming	Manual with alarms when conditions exist for selection or arming, otherwise automatic
Potential for interaction with other SPS's	Unacceptable except for intentional interaction with a Type III which results in no inter-Area impact. No unintentional interaction is acceptable.
SPS required for dynamic, voltage, or thermal response	Speed of response is adequate to protect against the need
Actions Taken	
- Dynamic	- Insertion of stabilizing devices, load rejection, or generation and/or import rejection ⁴
- Voltage	- Load rejection, generation and/or import rejection ⁴
- Thermal	- Load rejection, generation and/or import rejection ⁴ , or operation of transmission device
Exposure to operation	Continuous is acceptable
Permissible life of the SPS	Life of the associated project or until system changes make it unacceptable or unnecessary.
System Operation	An SPS actuation may not result in an unacceptable operating condition or in the increase in the amount of required operating reserve.

TABLE III

Acceptable Conditions for Type III SPS Application

Number of detection triggers for SPS	1 detection trigger per SPS ²
Number of actions triggered by an SPS	Limited actions within one station
Number of SPS's per action	2 SPS's per action unless complementary actions within one station ³
Location of monitoring	Local or remote
Location of action relative to SPS	Local or remote
Security & dependability	Per NPCC Document B11, Special Protection System Guideline
Selectivity of triggers	Selectivity may be reasonably adjusted by operators. An SPS must not operate for contingencies for which it is not intended to operate.
Arming	Manual with alarms when conditions exist for selection or arming, otherwise automatic
Potential for interaction with other SPS's	May interact with another Type III which results in no inter-Area impact. Type III should not cause Type I or Type II to operate.
SPS required for dynamic, voltage, or thermal response	Speed of response is adequate to protect against the need
Actions Taken	<ul style="list-style-type: none"> - Insertion of stabilizing devices, load rejection, or generation and/or import rejection⁴ - Load rejection, generation and/or import rejection⁴ - Load rejection, generation and/or import rejection⁴, or operation of transmission device
Exposure to operation	Continuous is acceptable
Permissible life of the SPS	Life of the associated project or until system changes make it unacceptable or unnecessary.
System Operation	An SPS actuation may not result in an unacceptable operating condition or in the increase in the amount of required operating reserve.

ISO NEW ENGLAND PLANNING PROCEDURE NO. 5-5

**SPECIAL PROTECTION SYSTEMS
APPLICATION GUIDELINES**

EFFECTIVE DATE: February 1, 2005

I. INTRODUCTION

A Special Protection System (SPS) is defined as a protection system designed to detect abnormal system conditions, and take corrective action other than the isolation of faulted elements. Such action may include changes in load, generation, or system configuration to maintain system stability, acceptable voltages or power flows. Automatic underfrequency load shedding, as defined in the NPCC *Emergency Operation Criteria* (Document A-3), is not considered an SPS. Conventionally switched, locally controlled shunt devices are not SPSs. (Ref. NPCC Document A-7)

Criteria for design and operation concerning transmission capability for Northeastern North America, including conditions specific to SPSs, are established in the NPCC *Basic Criteria for Design and Operation of Interconnected Power Systems* (Document A-2). Similar design conditions are specified for New England Control Area in Planning Procedure 3 "Reliability Standards for the New England Area Bulk Power Supply System" (the "Reliability Standards"). In addition to providing guidelines for the design, testing and operation of SPSs, the NPCC *Special Protection System Guideline* (Document B-11) categorizes SPSs according to the criteria fault for which it is designed and the impact its failure would have on the network.

II. PURPOSE

The above criteria and guidelines focus on the effects of proper and improper operation of SPSs, generally leading to a determination of need for individual SPS security and reliability. They provide no direction regarding situations in which an SPS might be appropriate or inappropriate in its application or functionality, or if particular design choices might result in unacceptable risk or complexity in operations. Such factors are included in these SPS application guidelines.

III. GUIDELINES

Tables I, II and III establish guidelines which constitute generally acceptable conditions for the application of SPSs in the New England Control Area, corresponding with the three categories of SPSs as defined by NPCC. Each SPS will be evaluated based on these guidelines and consideration of the potential impacts on system operations and reliability. Exceptions to these guidelines may be permitted in limited circumstances, based on an assessment of such factors as the extent of the deviation from the guidelines and the impact of such deviation on any associated reliability or security risk or the complexity of system operations. Conversely, consideration of such factors and alternatives, including upgrading the transmission system, may result in an SPS being judged unacceptable even though it adheres to the guidelines.

NPCC Type I SPSs

- NPCC Type I SPSs are associated with conditions resulting from Normal Criteria events; their failure or misoperation has the potential for significant adverse interarea impact.
- In general, a Type I SPS will not be used to mitigate the impacts of normal contingencies except in the following instances: 1) contingencies involving two adjacent circuits on a multicircuit tower, 2) contingencies whose impacts are confined to a limited local area¹,

even though the area is not wholly within the New England Control Area, and 3) contingencies with a transmission facility already out of service.

- The conditions of Table I apply

NPCC Type II SPSs

- NPCC Type II SPSs are associated with conditions resulting from Extreme Criteria events; their failure or misoperation has the potential for significant adverse impact outside of the local area.
- A Type II SPS will be considered as an acceptable mitigating measure, subject to the conditions of Table II.

NPCC Type III SPSs

- NPCC Type III SPSs are those that have potential for local impacts only.
- They are reviewed periodically to determine if, due to system changes, they have become Type I or Type II.
- A Type III SPS may be used, subject to the conditions of Table III.

Notes:

1. For the purpose of these SPS Application Guidelines, "local area" refers to an area comprising no more than 10% of the total New England Control Area load. Load external to the New England Control Area may be treated as if it was within the New England Control Area if the region the other load is within accepts the SPS and its associated risk. For this condition, NPCC design requirements apply for a Type I SPS; however, the Type III conditions for SPS application may apply depending on the nature and extent of the impact.
2. Parallel equipment which require multiple pickups for similar events are not counted as a separate events. Parameters monitored must all be located at the same station. For example, acceptable detection triggers could be each breaker within a substation or parallel lines between the same terminals; however, overloads measured at different stations would not be considered a single detection trigger.
3. An action is considered complementary if, once an action is taken by one SPS, that action is no longer needed by another SPS.
4. The design limit for resource rejection is 1200 MW, although there may be system conditions for which the operating limit may be higher.

Document History¹

Rev. 0	App.: RTPC, 6/8/99
Rev. 1	Eff.: 2/1/05

¹ This Document History documents action taken on the equivalent NEPOOL Procedure prior to the RTO Operations Date as well as revisions to the ISO New England Procedure subsequent to the RTO Operations Date.

TABLE I

Acceptable Conditions for Type I SPS Application

Number of detection triggers for SPS	1 detection trigger per SPS ²
Number of actions triggered by an SPS	Limited actions within one station
Number of SPS's per action	1 SPS per action unless complementary actions within one station ³
Location of monitoring	Local
Location of action relative to SPS	Local or radial connection
Security & dependability	Per NPCC Document B11, Special Protection System Guideline
Selectivity of triggers	Fixed response with no selectivity by operators. An SPS must not operate for contingencies for which it is not intended to operate.
Arming	Manual with alarms when conditions exist for selection or arming, otherwise automatic
Potential for interaction with other SPS's	Unacceptable except for intentional interaction with a Type III which results in no inter-Area impact. No unintentional interaction is acceptable.
SPS required for dynamic, voltage, or thermal response	Speed of response is adequate to protect against the need
Actions Taken	
- Dynamic	- Insertion of stabilizing devices, load rejection, or generation and/or import rejection ⁴
- Voltage	- Load rejection, generation and/or import rejection ⁴
- Thermal	- Load rejection, generation and/or import rejection ⁴ , or operation of transmission device
Exposure to operation	Continuous is acceptable
Permissible life of the SPS	Life of the associated project or until system changes make it unacceptable or unnecessary.
System Operation	An SPS actuation may not result in an unacceptable operating condition or in the increase in the amount of required operating reserve.

TABLE II

Acceptable Conditions for Type II SPS Application

Number of detection triggers for SPS	1 detection trigger per SPS ²
Number of actions triggered by an SPS	Limited actions within one station
Number of SPS's per action	1 SPS per action unless complementary actions within one station ³
Location of monitoring	Local
Location of action relative to SPS	Local or radial connection
Security & dependability	Per NPCC Document B11, Special Protection System Guideline
Selectivity of triggers	Fixed response with no selectivity by operators. An SPS must not operate for contingencies for which it is not intended to operate.
Arming	Manual with alarms when conditions exist for selection or arming, otherwise automatic
Potential for interaction with other SPS's	Unacceptable except for intentional interaction with a Type III which results in no inter-Area impact. No unintentional interaction is acceptable.
SPS required for dynamic, voltage, or thermal response	Speed of response is adequate to protect against the need
Actions Taken	
- Dynamic	- Insertion of stabilizing devices, load rejection, or generation and/or import rejection ⁴
- Voltage	- Load rejection, generation and/or import rejection ⁴
- Thermal	- Load rejection, generation and/or import rejection ⁴ , or operation of transmission device
Exposure to operation	Continuous is acceptable
Permissible life of the SPS	Life of the associated project or until system changes make it unacceptable or unnecessary.
System Operation	An SPS actuation may not result in an unacceptable operating condition or in the increase in the amount of required operating reserve.

TABLE III

Acceptable Conditions for Type III SPS Application

Number of detection triggers for SPS	1 detection trigger per SPS ²
Number of actions triggered by an SPS	Limited actions within one station
Number of SPS's per action	2 SPS's per action unless complementary actions within one station ³
Location of monitoring	Local or remote
Location of action relative to SPS	Local or remote
Security & dependability	Per NPCC Document B11, Special Protection System Guideline
Selectivity of triggers	Selectivity may be reasonably adjusted by operators. An SPS must not operate for contingencies for which it is not intended to operate.
Arming	Manual with alarms when conditions exist for selection or arming, otherwise automatic
Potential for interaction with other SPS's	May interact with another Type III which results in no inter-Area impact. Type III should not cause Type I or Type II to operate.
SPS required for dynamic, voltage, or thermal response	Speed of response is adequate to protect against the need
Actions Taken	
- Dynamic	- Insertion of stabilizing devices, load rejection, or generation and/or import rejection ⁴
- Voltage	- Load rejection, generation and/or import rejection ⁴
- Thermal	- Load rejection, generation and/or import rejection ⁴ , or operation of transmission device
Exposure to operation	Continuous is acceptable
Permissible life of the SPS	Life of the associated project or until system changes make it unacceptable or unnecessary.
System Operation	An SPS actuation may not result in an unacceptable operating condition or in the increase in the amount of required operating reserve.