

# Standard Authorization Request Form

Title of Proposed Standard	Determine Facility Ratings System Operating Limits and Transfer Capability
Request Date	March 20, 2002
<p>This is version 4 of this SAR, titled Facility Ratings 01 04, as posted on February 18, 2003. This version of the SAR has been submitted to the NERC Standards Authorization Committee for approval for standards drafting.</p>	

## SAR Requestor Information

Name	Jim Byrd (Wally Johnson as substitute)	<b>SAR Type</b> (Check box for one of these selections.)	
Company	Pepco	<input checked="" type="checkbox"/>	New Standard
Telephone	301-469-5252	<input type="checkbox"/>	Revision to Existing Standard
Fax		<input type="checkbox"/>	Withdrawal of Existing Standard <sup>1</sup>
E-mail	wajohnson@pepco.com	<input type="checkbox"/>	Emergency Action

## Purpose/Industry Need (Provide one or two sentences.)

Determine facility ratings, system operating limits, and transfer capabilities necessary to plan and operate the bulk electric system within predefined facility and operating limits such that cascading outages, uncontrolled system separation, and voltage and transient instability are avoided.

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### **Brief Description**

#### Facility Ratings:

Requirements shall be established for determining and communicating Facility Ratings needed to determine System Operating Limits and Transfer Capabilities. Facilities included in the standard shall be those that affect bulk electric system reliability such as substation, generation, and transmission equipment. The Facility Ratings to be addressed in the standard shall include thermal limits, voltage limits, and other limits as applicable to the equipment that comprise the facility.

#### System Operating Limits:

Requirements shall be established for determining System Operating Limits that adhere to Facility Ratings and predefined system reliability performance criteria such as voltage limits, frequency limits, power transfer limits ( thermal, voltage, and stability).

#### Transfer Capabilities:

Requirements shall be established for determining Transfer Capabilities that adhere to Facility Ratings, System Operating Limits and predefined system reliability performance criteria such as voltage limits, frequency limits, power transfer limits (both thermal and stability).

Notes: (1) During the standards drafting phase, the standard may be split into pieces, if appropriate.

(2) The NERC Functional Model has not been finalized. Modifications to the Functional Model may require similar modifications to the standard.

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***Reliability Functions\****

<b>The Standard will Apply to the Following Functions</b> <i>(Check box for each one that applies.)</i>		
<input checked="" type="checkbox"/>	Reliability Authority	Ensures the reliability of the bulk transmission system within its Reliability Authority area. This is the highest reliability authority.
<input type="checkbox"/>	Balancing Authority	Integrates resource plans ahead of time, and maintains load-interchange-resource balance within its metered boundary and supports system frequency in real time
<input type="checkbox"/>	Interchange Authority	Authorizes valid and balanced Interchange Schedules
<input checked="" type="checkbox"/>	Planning Authority	Plans the bulk electric system
<input type="checkbox"/>	Transmission Service Provider	Provides transmission services to qualified market participants under applicable transmission service agreements
<input checked="" type="checkbox"/>	Transmission Owner	Owens transmission facilities
<input checked="" type="checkbox"/>	Transmission Operator	Operates and maintains the transmission facilities, and executes switching orders
<input type="checkbox"/>	Distribution Provider	Provides and operates the "wires" between the transmission system and the customer
<input checked="" type="checkbox"/>	Generator	Owens and operates generation unit(s) or runs a market for generation products that performs the functions of supplying energy and Interconnected Operations Services
<input type="checkbox"/>	Purchasing-Selling Entity	The function of purchasing or selling energy, capacity and all necessary Interconnected Operations Services as required
<input type="checkbox"/>	Load-Serving Entity	Secures energy and transmission (and related generation services) to serve the end user

\*Please refer to the Detailed Description. Not all aspects of this SAR apply to all the functions checked.

**Reliability and Market Interface Principles**

<b>Applicable Reliability Principles</b> (Check box for all that apply.)	
<input checked="" type="checkbox"/>	1. Interconnected bulk electric systems shall be planned and operated in a coordinated manner to perform reliably under normal and abnormal conditions as defined in the NERC Standards.
<input checked="" type="checkbox"/>	2. The frequency and voltage of interconnected bulk electric systems shall be controlled within defined limits through the balancing of real and reactive power supply and demand.
<input checked="" type="checkbox"/>	3. Information necessary for the planning and operation of interconnected bulk electric systems shall be made available to those entities responsible for planning and operating the systems reliably.
<input checked="" type="checkbox"/>	4. Plans for emergency operation and system restoration of interconnected bulk electric systems shall be developed, coordinated, maintained and implemented.
<input type="checkbox"/>	5. Facilities for communication, monitoring and control shall be provided, used and maintained for the reliability of interconnected bulk electric systems.
<input type="checkbox"/>	6. Personnel responsible for planning and operating interconnected bulk electric systems shall be trained, qualified and have the responsibility and authority to implement actions.
<input checked="" type="checkbox"/>	7. The security of the interconnected bulk electric systems shall be assessed, monitored and maintained on a wide area basis.
<b>Does the proposed Standard comply with all of the following Market Interface Principles?</b> (Select 'yes' or 'no' from the drop-down box.)	
1. The planning and operation of bulk electric systems shall recognize that reliability is an essential requirement of a robust North American economy. Yes	
2. An Organization Standard shall not give any market participant an unfair competitive advantage. Yes	
3. An Organization Standard shall neither mandate nor prohibit any specific market structure. Yes	
4. An Organization Standard shall not preclude market solutions to achieving compliance with that Standard. Yes	
5. An Organization Standard shall not require the public disclosure of commercially sensitive information. All market participants shall have equal opportunity to access commercially non-sensitive information that is required for compliance with reliability standards. Yes	

## **Detailed Description**

Reliable operation of the bulk power system requires quantification of the ability of the bulk power system to reliably transmit electric power. Therefore, detailed knowledge of equipment ratings and Facility Ratings for all of the components in the power system is required to determine the maximum permissible power flows through a facility (or set of facilities), and to determine the limits to power transfers while operating according to applicable reliability criteria. Appropriate equipment ratings, System Operating Limits and Transfer Capabilities are fundamental building blocks for the proper planning of the system to ensure its reliable operation.

This Standard requires that limits be determined to ensure the reliable planning and operation of the bulk electric system. Although planning and operating limits may differ due to the degree of uncertainty involved, both must not exceed Facility Ratings.

This standard does not address operating reserve requirements or the control of unscheduled flows; these issues are addressed in other standards.

## **Facility Ratings**

Definitions:

Facility – a set of electrical equipment that operate as a single bulk power system element (e.g., a line, a generating unit, a shunt compensator, etc).

Facility Rating – the maximum or minimum voltage, current, real or reactive power flow through a facility that does not violate an applicable rating of any equipment comprising the facility

Equipment Rating – the maximum and minimum voltage, current, frequency, real and reactive power flows on individual equipment apparatus under steady state, short-circuit and transient conditions, as permitted or assigned by the equipment owner.

This standard will apply to all transmission and generation facilities in the bulk electric system. Transmission owners and generator owners determine their respective facility ratings and must ensure that this information is supplied to entities responsible for the Reliability Authority, Transmission Operator and Planning Authority functions in a timely manner.

The responsibility for equipment ratings remains with the owners of the equipment (i.e. transmission owners and generation owners). Accordingly, individual pieces of equipment will have ratings established by the owners. In establishing the ratings, owners should consider items such as: other industry standards (e.g., IEEE, ANSI, CSA), equipment warranties, the age of equipment, the expected replacement date of the equipment, the climatic conditions, performance testing, prior problems with the equipment and maintenance condition. Each equipment rating must be applied consistently in reliability studies and system operations.

The equipment ratings determined by generator and transmission owners must not be violated when calculating System Operating Limits and Transfer Capabilities.

Facility Ratings shall not result in the violation of the respective equipment ratings of each piece of equipment that forms the facility (for example in the case of a transmission line: bus conductor, CTs, PTs, protection, risers, line conductor, wave traps, filters, line reactors, breakers, and line disconnects).

The standard will state that equipment owners must document the methodology they employ to determine facility ratings and must make the methodology available to NERC, NERC Regions or their successors and entities performing the Reliability Authority and Planning Authority functions upon request. In addition, equipment owners must make applicable Facility Ratings (not limited to steady-state ) available

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to NERC, NERC Regions or their successors, and entities performing the Reliability Authority and Planning Authority functions in a pre-defined form, including the conditions under which the ratings apply (ie, seasonal, emergency, normal, short-term, etc). These ratings must be adhered to in the development of Transfer Capabilities and System Operating Limits.

This Standard does not require the development or use of a single methodology for the calculation of equipment or Facility Ratings.

This portion of this standard will address the need for timely submission of accurate and complete Facility Ratings information including the methodology used to determine them to the users of this information.

Possible Measures:

1. Availability of a documented Facility Ratings methodology
2. Availability of Facility Ratings
3. Consistency of Facility Ratings with the Facility Ratings methodology

### System Operating Limits

Definitions:

System Operating Limit – the maximum or minimum permissible loading on a facility or a limited group of facilities without violating applicable Facility Ratings and reliability criteria, as determined through system studies and/or operational experience. System Operating Limits may result from voltage, thermal or stability limits associated with one or more facilities. (Stability and voltage limits will be reflected as a permissible loading level). System Operating Limits may refer to limits in both real-time operations and planning studies.

Entities performing the Reliability Authority, Transmission Operator and Planning Authority functions shall establish System Operating Limits to define the maximum reliable loadings for facilities within the bulk power system. System Operating Limits must be provided to those responsible for the reliable operation of the system in a timely manner (as determined by the Reliability Authority). Such limits will be monitored and adhered to by those responsible for system operation {See SAR: Operate Within Transmission System Limits - Monitor and Assess Short-term Reliability}.

This standard will require that reliability margins be considered, identified, and defined in the determination of System Operating Limits where appropriate. Such margins might reflect: uncertainty in system conditions (demand levels, generation dispatch), operation of controllable elements such as phase shifting transformers, and the impact of third party loop flows, or other uncertainties.

The standard will state that those determining System Operating Limits must provide supporting information regarding the limits to NERC, NERC Regions or their successors and entities performing the Reliability Authority and Planning Authority functions upon request.

The determination of System Operating Limits must address:

- the applicable (such as seasonal, normal, emergency, short term etc) Equipment Ratings and Facility Ratings
- applicable contingencies

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- the accuracy and tolerances of system models
- special protection systems or remedial action plans (see SAR “Assess Transmission Future Needs and Develop Transmission Plans”)
- transmission system configuration, generation dispatch and load level
- the assumptions implicit in the limits developed,

System Operating Limits, which will be applicable to flows through a specific transmission facility or interface in the system, must then provide a reasonable certainty that the following do not occur:

- uncontrolled separation within the system
- cascading outages
- voltage and transient instability
- violation of applicable reliability performance criteria (for example, in the planning horizon, as specified in Table 1: Transmission System Standards – Normal and Contingency Conditions, page 13 of the current NERC Planning Standards.  
[ftp://www.nerc.com/pub/sys/all\\_updl/pc/pss/ps9709.pdf](ftp://www.nerc.com/pub/sys/all_updl/pc/pss/ps9709.pdf) )

Depending upon local system conditions, a System Operating Limit may be a relatively independent quantity (indicating relative independence of the conditions on other facilities) or may be an interdependent quantity expressed in nomograms or equations indicating dependencies on other interfaces or transmission facilities, prior-outage conditions and other system conditions.

This portion of this standard will address the need to determine and deliver System Operating Limits to system operators

Possible Measures:

1. Availability of System Operating Limits
2. Consistency with Equipment and Facility Ratings

### **Transfer Capability**

Definitions:

Transfer Capability – measure of the ability of the interconnected electric system to reliably move or transfer electric power from one area to another over all transmission lines (or paths) between those areas under specified system conditions. The determination of Transfer Capability must adhere to applicable System Operating Limits.

Use of the system shall not exceed the Transfer Capability. This standard does not address Available Transfer Capability (ATC), other transfer capabilities determined for commercial reasons, or the margins associated with these quantities. The entities performing the Reliability Authority, Planning Authority, and the Transmission Operator functions may calculate transfer capabilities in the fulfillment of their respective responsibilities. The determination of Transfer Capability must consider transmission system topology, system demand, generation dispatch, current and projected transmission uses, and system limitations.

This standard will require that reliability margins be considered, identified and defined in the determination of Transfer Capability where appropriate. Such margins might reflect: uncertainty in system conditions

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(demand levels, generation dispatch), operation of controllable elements such as phase shifting transformers, and the impact of third party loop flows.

The standard will state that those determining Transfer Capabilities must provide supporting information regarding the capabilities to NERC, NERC Regions or their successors and entities performing the Reliability Authority and Planning Authority functions upon request.

Possible Measures:

Transfer Capabilities must be made available for use in reliability assessments.

Consistency with Equipment and Facility Ratings and System Operating Limits.

***Related SARs***

<b>SAR ID</b>	<b>Explanation</b>
OPER_WITHN_LMTS_01_02	The Operate Within Transmission System Limits - Monitor and Assess Short-term Reliability SAR is developed on the assumption that facility ratings and operating limits have been established.
TRNS_NDS_&_PLNS_01_01	The Assess Transmission Future Needs and Develop Transmission Plans SAR will use some of the data collected within this SAR.
COORD_OPERATONS_01_01	The Coordinate Operations SAR will include requirements that Transmission Operators share operating limits with other Transmission Operators.

***Regional Differences***

<b>Region</b>	<b>Explanation</b>
ECAR	
ERCOT	
FRCC	
MAAC	
MAIN	
MAPP	



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NPCC	NPCC has stated that they have more stringent requirements for portions of this standard.
SERC	
SPP	
WECC	WECC has requested a difference, based upon their existing RMS program and that the majority of WECC members currently determine SOLs (in the form of Path Ratings and Operating Transfer Capabilities), rather than TCs as defined in this SAR.

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**Implementation Plan**

**Description** (Provide plans for the implementation of the proposed standard, including any known systems or training requirements.)

(To be developed)

**Related NERC Planning Standards/Operating Policies**

Standard No.	Explanation
Planning Std I A	Plan within ratings, avoid cascading outages, uncontrolled system separation, and voltage and transient instability
Planning Std I B S1 M2	Items 5-6, transfer capability/system conditions
Planning Stds I E	Total Transfer Capability
Planning Stds II B	Generator ratings
Planning Stds II A	Facility ratings, system data
Planning Std II C	Facility ratings
Operating Policy 2 A	Operating Security Limits
Operating Policy 3 B	Total Transfer Capability
Operating Policy 6 A	Transfer limits

**Proposed Implementation:**

(To be developed)

**SAR Drafting Team**

<b>Chairman</b>	Chifong Thomas
<b>Secretary</b>	Tim Gallagher
<b>Requestor</b>	Jim Byrd/Wally Johnson
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