STANDARDS COMMITTEE

MIDWEST RELIABILITY ORGANIZATION

STANDARD APPLICATION GUIDE

FAC-008-3

Version 1.1

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The Midwest Reliability Organization (MRO) Standards Committee (SC) is committed to providing training and non-binding guidance to industry stakeholders regarding existing and emerging Reliability Standards. Any materials, including presentations, were developed through the Standards Committee by Subject Matter Experts from member organizations within the MRO.

Subject Matter Experts in the field of Facility Ratings were brought together in 2012, to prepare a guide for complying with NERC Reliability Standard FAC-008-3. Participants include representatives from the Generator Owner and Transmission Owner registration functions.

FAC-008-3 Subject Matter Expert –Standard Application Guide Development Team

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The materials have been reviewed by MRO staff and provide reasonable application guidance for the standard addressed. Ultimately, demonstrating compliance depends on a number of factors including the precise language of the standard, the specific facts and circumstances, and quality of evidence.

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Acknowledgement

This publication was developed by a team of Subject Matter Experts (SME) from MRO member organizations within the MRO footprint. The development of SME teams is an ongoing effort to produce unified application guides for MRO and its Registered Entities.

The FAC-008-3 SME team chair, Terry Harbour from MidAmerican Energy, wishes to acknowledge and thank those who dedicated efforts and contributed significantly to this publication. The MRO and the MRO Standards Committee, and their organizational affiliations include:

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TABLE OF CONTENTS

Introduction

FERC approved NERC Reliability Standard **FAC-008-3 – Facility Ratings** (FAC-008-3) replacing NERC Reliability Standards FAC-008-1 and FAC-009-1. FAC-008-3 is applicable to Transmission Owners (TO) and Generator Owners (GO) which are required to determine Facility Ratings (Normal and Emergency) with respect the most limiting piece of applicable equipment.

The major modifications to FAC-008-3 are:

1. GO requirements for documentation versus a methodology, for behind the main transformer.
2. The addition of a "next most limiting" rating.
3. The addition of impaired equipment as an operating limit.

Purpose

To ensure that Facility Ratings used in the reliable planning and operation of the Bulk Electric System (BES) are determined based on technically sound principles. A Facility Rating is essential for the determination of System Operating Limits.

Overview

There were three directives in Order 693 relative to FAC-008-1 – Facility Ratings. The version of FAC-008-2 that was approved by NERC BOT in 2010 only addressed the first two of the three directives. FERC's September 16, 2010 Order Denying Rehearing, Denying Clarification, Denying Reconsideration, and Denying Request for a Stay on its March 18, 2010 Order included the following clarification regarding the third directive:

> *"In order to determine facility ratings, entities must identify the most limiting component that comprises the facility, based on a validated methodology that considers the specific characteristics and ratings of all of the components to determine their limits for a range of ambient conditions, including if and for what duration these limits can be exceeded. This is, in part, because the limiting element upon which a facility rating is based can change under different operating conditions.*
>
> *For example, an underground high voltage cable may be the limiting element for continuous ratings, but a disconnect switch may be the limiting element for a four-hour emergency rating. With heavy power flows from generators through critical facilities to load, contingency conditions could reveal a thermal overload above the normal rating of the first limiting component of one of these facilities.*
>
> *However, that component also likely has a documented short time rating that could sustain the overload. If the second-most limiting component does not afford much increase in rating above the first, and its overload can result in the unintended removal*

of the facility from service (i.e., a relay or other protection system component that trips a facility out of service due to the overload), the prior identification of this second limiting component could alter the mitigation plans and avoid relay operations that trip facilities out-of-service, and thus potentially prevent a cascading event."

The goals of this Standard Application Guide include the following:

- Provide guidance for developing Facility Ratings that are consistent with industry standards developed through an open process such as IEEE or CIGRE, manufacture ratings (OEM) ratings or testing;

- Provide guidance for identifying the limiting component(s) and defining the increase in rating based on the next limiting component(s) for all critical facilities consistent with R8.2.1 and;

- Describe the processes and outcomes that can be used for the appropriate application of the standard to support the reliability of the Bulk Electrical System (BES).

Application

This section contains suggested applications to meet the Requirements of FAC-008-3. These applications represent the recommended practices of the MRO FAC-008-3 SAG SME Team

Requirement R1 Application

R1. *Each Generator Owner shall have **documentation for determining the Facility Ratings** of its solely and jointly owned generator Facility (ies) up to the **low side terminals of the main step up** transformer if the Generator Owner does not own the main step up transformer and **the high side terminals of the main step up transformer** if the Generator Owner owns the main step up transformer. [Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]*

1.1. The documentation **shall contain assumptions** used to rate the generator **and at least one of the following**:

- Design or construction information such as **design criteria, ratings provided by equipment manufacturers**, equipment drawings and/or **specifications**, **engineering analyses**, method(s) consistent with **industry standards** (e.g. ANSI and IEEE), or an **established engineering practice** that has been verified by testing or **engineering analysis**.
- *Operational information such as **commissioning test results**, **performance testing** **or historical performance records**, any of which may be supplemented by **engineering analyses**.*

1.2. *The documentation shall be consistent with the principle that the Facility Ratings do not exceed the most limiting applicable Equipment Rating of the individual equipment that comprises that Facility.*

The scope of applicable equipment in Requirement R1 is different based upon the ownership of the generator step-up (GSU) transformer. If the GO does not own the GSU, the scope of equipment is from the generator up to the low side terminals of the GSU transformer. If the GO owns the GSU the documentation required in R1 extends to the high side terminals of the GSU. (Figure 1)

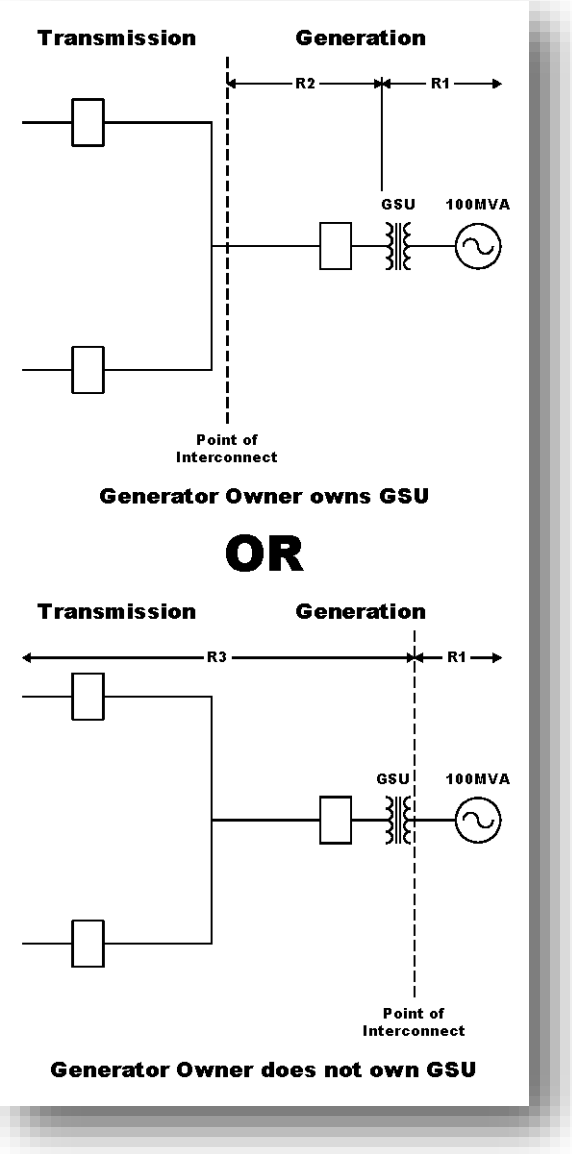

Figure 1. Requirement applicability based upon ownership

It should be noted that Requirement R1 does not require methodology. R1 requires GOs to utilize documentation supporting the rating of each Element in the Facility from the generator up to the GSU low side bushings if the GO does not own the GSU; or to the high side bushings if the GO owns the GSU.

GOs should ensure that Facility Ratings are consistent with the R1 documentation by developing a list of each Element of the generator facility. The list shall identify at least one rating for each of the Elements of the facility and identify the document supporting the identified rating. In addition, the documentation shall identify the assumption(s) used to rate the generator and at least one of the following sources:

- Examples of design or construction information includes:
  - Nameplate ratings
  - Design drawings
  - Engineering Analysis
  - Test results
  - Ampacity diagram (figure 2)

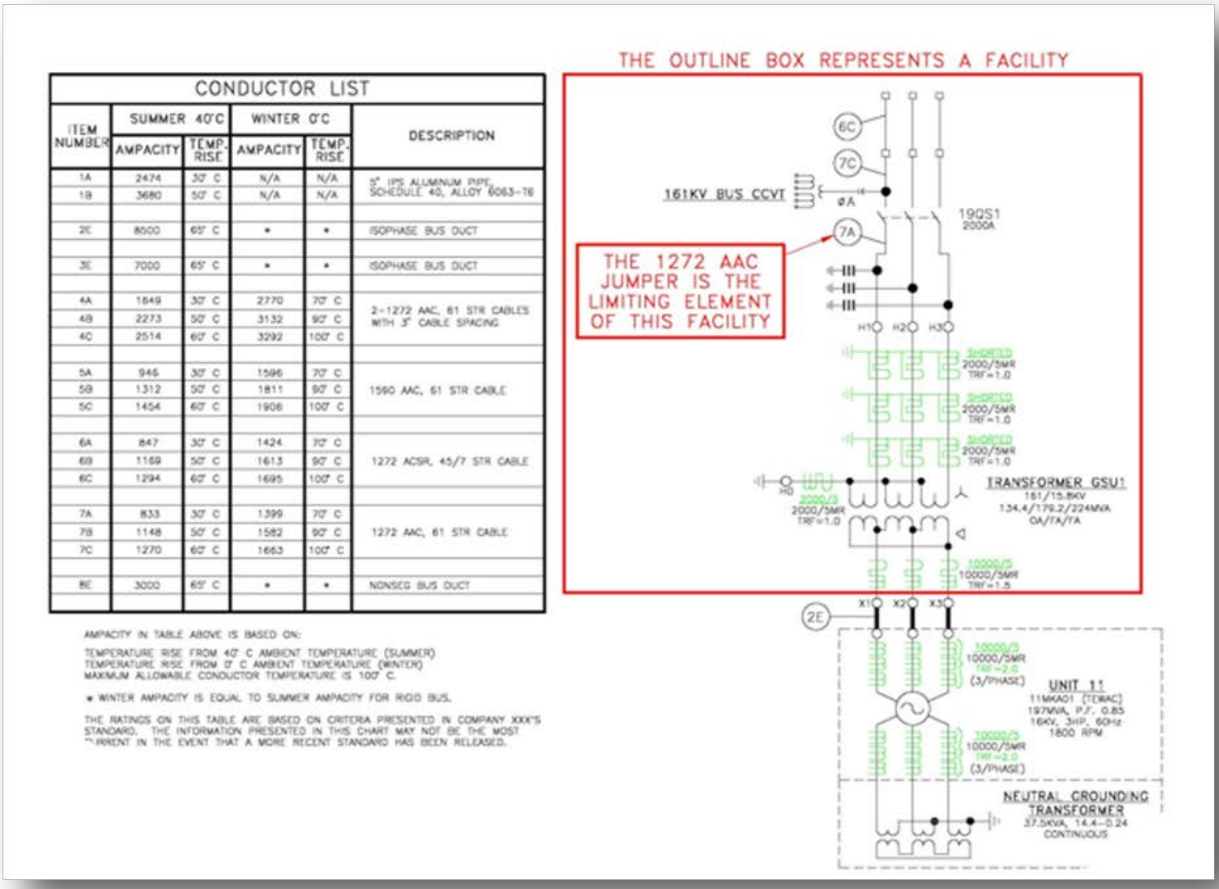

Figure 2. Sample Ampacity Diagram

Examples of operational information includes:

- Average monthly temperature data may be collected for each station to be used for ambient condition unit rating determinations.

- Annual real power verification testing may be performed and manufacture published performance capability data used to determine monthly temperature corrected unit ratings
- Ratings may be estimated from real power verification testing and published performance capability data.

From the list of Elements and their associated ratings, the GO shall be able to clearly identify the most limiting element of the Facility to determine its Facility Rating.

FAC-008-3 Requirement R1 does not require Emergency Ratings for Elements**.**

Requirement R2 and R3 application

Requirements R2 and R3 have similar requirements for GOs and TOs and require the development of a Facility Ratings methodology (FRM). The primary difference between the two requirements is that Requirement R2 applies to GOs and Requirement R3 applies to TOs. For brevity, the application of these two requirements are presented together in this document. Note that each requirement or sub-requirement must be addressed. At least one bullet under each requirement or sub-requirement must be addressed.

R2. *Each Generator Owner* ***shall have a documented methodology*** *for determining Facility Ratings (Facility Ratings Methodology) of its* ***solely and jointly owned equipment*** *connected between the location specified in R1 and the point of interconnection with the Transmission Owner that* ***contains all of the following****. [Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]*

2.1. *The* ***methodology used*** *to establish the Ratings of the equipment that comprises the Facility(ies) shall be consistent* ***with at least one*** *of the following:*

- ***Ratings provided by equipment manufacturers*** *or obtained from equipment manufacturer specifications such as nameplate rating.*
- ***One or more industry standards*** *developed through an open process such as Institute of Electrical and Electronic Engineers (IEEE) or International Council on Large Electric Systems (CIGRE).*
- *A* ***practice*** *that has been* ***verified by testing, performance history or engineering analysis***

2.2. *The* ***underlying assumptions****,* ***design criteria****, and* ***methods used*** *to determine the Equipment Ratings identified in Requirement R2, Part 2.1 including identification of how each of the following were considered:*

2.2.1. ***Equipment Rating standard(s)*** *used in development of this methodology.*

2.2.2. ***Ratings provided by equipment manufacturers*** *or obtained from equipment manufacturer specifications.*

2.2.3. ***Ambient conditions*** *(for particular or average conditions or as they vary in real-time).*

2.2.4. ***Operating limitations****.* [1]

[1] *Such as temporary de-ratings of impaired equipment in accordance with good utility practice*

2.3. *A statement that a Facility Rating shall respect the most limiting applicable Equipment Rating of the individual equipment that comprises that Facility.*

2.4. *The* ***process*** *by which the Rating of equipment that comprises a Facility is determined.*

2.4.1. *The* ***scope of equipment addressed shall include, but not be limited to, conductors, transformers, relay protective devices, terminal equipment, and series and shunt compensation devices.***

2.4.2. *The scope of* ***Ratings*** *addressed* ***shall include****, as a minimum, both* ***Normal and Emergency Ratings****.*

R3. *Each Transmission Owner* ***shall have a documented methodology*** *for determining Facility Ratings (Facility Ratings Methodology) of its* ***solely and jointly owned*** *Facilities (except for those generating unit Facilities addressed in R1 and R2) that* ***contains all*** *of the following: [Violation Risk Factor: Medium] [Time Horizon: Long-term Planning]*

3.1. *The methodology used to establish the Ratings of the equipment that comprises the Facility shall be consistent with at least one of the following:*

- ***Ratings provided by equipment manufacturers*** *or obtained from equipment manufacturer specifications such as nameplate rating.*
- ***One or more industry standards*** *developed through an open process such as Institute of Electrical and Electronics Engineers (IEEE) or International Council on Large Electric Systems (CIGRE).*
- ***A practice that has been verified*** *by testing, performance history or engineering analysis.*

3.2. *The* ***underlying assumptions****,* ***design criteria****, and methods used to determine the Equipment Ratings identified in Requirement R3, Part 3.1 including identification of* ***how each*** *of the following were considered:*

3.2.1. ***Equipment Rating standard(s)*** *used in development of this methodology.*

3.2.2. ***Ratings provided by equipment manufacturers*** *or obtained from equipment manufacturer specifications.*

3.2.3. ***Ambient conditions*** *(for particular or average conditions or as they vary in real-time).*

3.2.4. ***Operating limitations****.*[2]

3.3. *A statement that a Facility Rating shall respect the most limiting applicable Equipment Rating of the individual equipment that comprises that Facility.*

3.4. *The* ***process*** *by which the Rating of equipment that comprises a Facility is determined.*

3.4.1. *The* ***scope of equipment addressed shall include****, but not be limited to, transmission conductors, transformers, relay protective devices, terminal equipment, and series and shunt compensation devices.*

3.4.2. *The* ***scope of Ratings addressed*** *shall include, as a minimum, both* ***Normal*** *and* ***Emergency*** *Ratings.*

[2] *Such as temporary de-ratings of impaired equipment in accordance with good utility practice.*

Ratings are the basic building block of a transmission network or generation facility. Ratings determine the System Operating Limits. Their scope shall include both **Normal** and **Emergency** ratings. The Normal Ratings should be based upon continuous operation without loss of life to the facility. The GO or TO must determine an acceptable loss of life before determination of its Emergency Ratings. This will vary depending upon the configuration of the system. If the owner has determined the acceptable loss of life is equal to zero, the Emergency Rating can be set to the Normal Rating if that is your practice.

A FRM for Elements in the current path should be developed. This FRM needs a solid technical foundation such as industry standards, information from manufacturers, or test data.

The FRM must document how ambient conditions were considered, according to Requirement R2.2.3 and R3.2.3. These ambient conditions should be consistent with the ambient conditions in the region in which the facilities will operate. If the ambient conditions vary throughout the year, consideration should be given to having more than one rating set (e.g., a winter set and a summer set, or a set for each of the four seasons). A Normal and Emergency Rating should be developed for each rating set.

The FRM should also document the assumption that the equipment is operating as designed and needs to have provisions for modifying the rating should temporary operating conditions occur (e.g. a hot spot on a disconnect switch or loss of cooling fans on a transformer), temporary changes apply towards the ratings themselves and does not require a change in the methodology. The sources for equipment ratings and assumptions utilized in the FRM may be identified through the use of matrices (Figures 3 and 4) or through a narrative specific to each type of equipment that includes a description of each input and how they are applied.

Electrical Element or components	Example Methodology R2.1/R3.1 One of the following				
	Manufacturer	Industry Standard	Verified practice. One of the following		
			Testing	Performance History	Engineering Analysis
Generator		X	X	X	X
Generator Step Up Transformer		X			
ISO Phase Bus		X			X
Overhead Conductor		X			
Line switch		X			
Cable Conductor		X			
Circuit breakers		X			
Current Transformers		X			
Jumper Conductors		X			
Disconnect switch		X			
Power transformer	X	X			
Rigid bus conductor		X			
Circuit breakers – GIS	X				
Series Compensation	X				
Other electrical Components as			X		

Figure 3. Equipment Rating Sources Must Include at Least One Method from the Three Columns Manufacturer, Industry Standard, or Verified Practice

	R2.2/R3.2 Identification of the Underlying Assumptions/Design Criteria/Methods Employed			
Element	Equipment Rating Standards Used (example standards only-is not inclusive of all possible standards) R2.2.1/R3.2.1	Ratings Provided by Manufacturer- or Equipment Specifications R2.2.2/R3.2.2	Ambient Conditions R2.2.3/R3.2.3	Operating Limitations R2.2.4/R3.2.4
Transmission Conductor	Calculations per IEEE 738	Input to Calculations	Input to Calculations	Input to Calculations
Transmission Line Switch	Calculations per ANSI C37.37	Input to Calculations	Input to Calculations	Input to Calculations
Underground Transmission Cable	Calculations per IEEE 835	Input to Calculations	Input to Calculations	Input to Calculations
Circuit Breakers	Calculations per ANSI C37.010	Input to Calculations	Input to Calculations	Input to Calculations
Current Transformers	Calculations per C57.13	Input to Calculations	Input to Calculations	Input to Calculations
Jumper Conductors	Calculations per IEEE 738	Input to Calculations	Input to Calculations	Input to Calculations
Substation Disconnect Switch	Calculations per ANSI C37.37	Input to Calculations	Input to Calculations	Input to Calculations
Power Transformer	Calculations per ANSI C57.12.00	Input to Calculations	Input to Calculations	Input to Calculations
Series Compensation	Not Applicable	Nameplate	Input to Calculations	Input to Calculations
Rigid Bus Conductor	Calculations per IEEE 605	Input to Calculations	Input to Calculations	Input to Calculations
Circuit breake		Namepl		Input to

Figure 4. Identification of Underlying Assumptions, Design Criteria and Methods used

Examples – Equipment Rating Processes when not using manufacture's nameplate:

Transformers:

Document the software program used to determine operating limits, such as IEEE. C57.91 Transformer Loading Guide used to calculate emergency ratings for transformers (R2.2.1). However, if the transformer is known to have design issues – (gassing or stray flux -), it may be limited to the manufacturer's nameplate capability (2.2.2 and 2.2.4). The IEEE / ANSI standard C57 considered ambient conditions (2.2.3). The emergency overload rating is based off an operating limitation of X degrees rise over ambient (R2.2.4).

When the operating limitation of equipment or a component is identified during inspections to be operating outside expected parameters, make a case specific evaluation and take appropriate action.

Circuit Breakers:

Equipment Rating Standards Used – IEEE / ANSI C37.010 (R2.2.1E)

Ratings Provided by Manufacturer are based off of Industry standard and the owner's defined ambient conditions and operating conditions (per specification of the circuit breaker (R2.2.2)

- Documented in Certified Drawings and/or Nameplate

Ambient Conditions are defined in Entities Specification (R2.2.3)

- Documented in Certified Drawings and/or Nameplate

Operating Limitations are defined by the IEEE / ANSI standards

Line Conductors:

Equipment Rating Standards Used - IEEE Standard 738 (R3.2.1). The conductor's top capability, such as 100 Degrees C maximum operating temperature, were considered to avoid annealing (R3.2.2, and R3.2.4).

Ambient Assumptions (R3.2.3):

The normal and emergency bare overhead conductor rating shall be calculated under the following assumed atmospheric conditions:

- *Ambient air temperature of 100 degrees F for summer season ratings and 32 degrees F for winter season ratings*
- *A wind velocity of 7 ft/sec*
- *An incident wind angle of 20 degrees*
- *The following solar factors:*
  - *Latitude of 41 degrees north and longitude of 95 degrees west*

Transmission lines may be limited to less than thermal capability for relay loading limits where applicable.

Remember to include the components that may need additional consideration when rating the overall Element. For example:

- Bushings / Load Tap Changers / No-Load Tap Changers sometimes limit the emergency capability of a power transformer and should be included
- Current transformers in a circuit breaker or transformer could either be included in the rating of the circuit breaker or transformer or rated separately
- Limitations set by relay protective devices, are the limitation based upon the thermal limitation of the relay, the relay settings, or both
- System meters or telemetry equipment may contribute to exceeding a series circuit electrical rating and resulting Element damage

Once a means of rating each element and component has been developed, the "**Facility** or **Facilities**" need to be defined. A Facility is (per NERC Glossary of Terms) a "set of electrical equipment that operates as a single Bulk Electric System Element." Facilities may vary slightly by owner but will generally include anything from the generator to the point of transmission interconnect for a generator and transformers, lines, and busses for a Transmission Facility. During the process to develop the list of Facilities, it should be noted which of the Facilities are jointly owned in order to coordinate the ratings of those Facilities with the other owner(s).

The Facility Rating needs to reflect the most limiting element or component that is included in the Facility. The document must include a statement that meets R3.3:

> *Facility Rating shall respect the most limiting applicable Equipment Rating of the individual equipment that comprises that Facility.*

Facility Ratings documentation should include the scope of equipment/elements/components to be included and details on how the rating is determined.

For a generator interconnection Facility, this may include the:

- generator leads
- current transformers
- relay protective, metering and/or telemetry devices
- bus work, rigid and/or stranded
- generator circuit breaker
- generator step up transformer
- jumpers
- disconnect switches

For a transmission owner, this may include:

- bus work, rigid and/or stranded
- jumpers from a network bus at substation
- disconnect switch
- current transformers
- relay protective, metering and/or telemetry devices
- circuit breaker or circuit switchers
- power transformers
- jumpers, jumpers to line wave trap and line
- wave trap,
- Series devices such as: reactors, capacitors, power electronic flow-limiters
- line sectionalizing switch
- line conductor

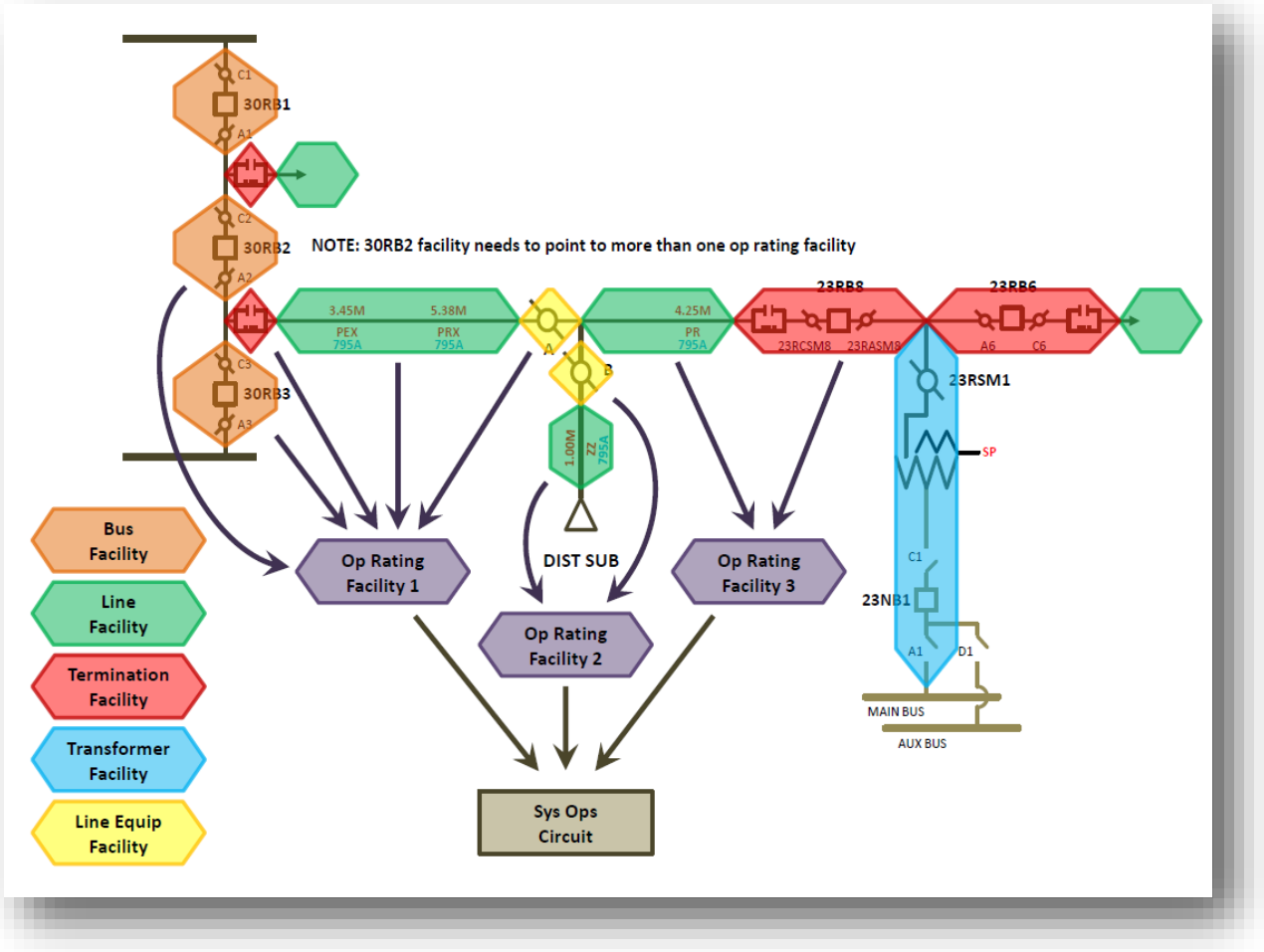

Figure 5. Facility Methodology

Examples of How to Define Facilities:

A key concept is that you must have adequate granularity to support your planning and operating functions regardless of the method chosen to define Facilities to support reliable operations. Figure 5 is just one possible method of meeting the standard. Entities can use a variety of ways to ensure that all series elements are rated for a Facility. Entities can use a component block coverage method, node-to-node coverage, or breaker-to-breaker coverage as long as all series components are considered to make a Facility Rating.

Facility Rating Sample FAC008 R6	From Substation; MRO1	To Substation; MRO2	Summer Normal (SN)	Summer Emergency (SE)	Winter Normal (WN)	Winter Emergency (WE)
Facility Limits: MRO1 to MRO2			1030	1043	1221	1231
Facility Limits: MRO2 to MRO1			1030	1043	1221	1231
Substation: MRO1	Owner: Utility A					
Equipment	Description		SN	SE	WN	WE
Conductor	1 - 795.0 kcmil ACSR 26/7 Drake, JUMPER, 200°F Norm, 300°F Emer		1030	1402	1221	1524
Trap	2000A, B-Phase		2040	2240	2100	2400
Conductor	2 - 1590.0 kcmil AAC 61 Coreopsis, JUMPER, 200°F Norm, 275°F Emer		3096	4000	3668	4404
Switch	1600A, Switch #78661-L, AO6		1795	2126	2264	2482
Conductor	2 - 1272.0 kcmil AAC 259 Rope-Lay, JUMPER, 200°F Norm, 275°F Emer, 5% derate proximity effect		2637	3401	3124	3743
CT	1200:5 Full Ratio, 1200:5 Conn Tap, RF = 2.00, Bushing (Bkr)-Type		2400	2400	2400	2400
Circuit Breaker	1600 A, OIL, Device #78661		1704	1894	2101	2264
Relay	Forward.Setting		5631	5631	5631	5631
Relay	Non-Directional.Thermal		3600	3600	3600	3600
RTU	RTU		13708	13708	13708	13708
CT	1200:5 Full Ratio, 1200:5 Conn Tap, RF = 2.00, Bushing (Bkr)-Type		2400	2400	2400	2400
Conductor	2 - 1272.0 kcmil AAC 259 Rope-Lay, JUMPER, 200°F Norm, 275°F Emer, 5% derate proximity effect		2637	3401	3124	3743
Switch	1600A, Switch #78661-B, AO6		1795	2126	2264	2482
Conductor	1 - 5.0" Al Tube, Sch 40, 6063-T6, BUS		4608	5075	5590	5998
From- To Nodes	Line Segments - Description		SN	SE	WN	WE
MRO1 to STR 125	1 - 795.0 kcmil ACSR 26/7 Drake, 200°F Norm, 245°F Emer		1030	1214	1221	1367
STR 125 to MRO2	1 - 795.0 kcmil ACSR 26/7 Drake, 200°F Norm, 203°F Emer		1030	1043	1221	1231
Substation: MRO2	Owner: Utility B					
Equipment	Description		SN	SE	WN	WE
Conductor	1 - 795.0 kcmil ACSR 26/7 Drake, JUMPER, 200°F Norm, 300°F Emer		1030	1402	1221	1524
Trap	1200A, B-Phase		1224	1344	1260	1440
	JUMPER, 200°F Norm		1030	1402		1524

Figure 6. Database Facility inventory with individual equipment ratings

As each piece of equipment is identified it should be recorded with some type of data tracking tool by Facility. This may be as simple as a spreadsheet or a complex data management tool (Figure 6).

The Facility Ratings methodology should address how the Facility Rating will be addressed for jointly owned Facilities. The owners may share all of their equipment ratings with each other in order to identify the most limiting Element or share only their respective most limiting elements to determine the overall most limiting element for the Facility.

Provisions to address requests for identification of the next existing most limiting equipment and its thermal rating should be addressed in the methodology for facilities that are associated with one of the following:

- An Interconnection Reliability Operating Limit,
- A limitation of Total Transfer Capability,
- An impediment to generator deliverability, or

- An impediment to service to a major load center.

One purpose of identifying the next most limiting thermal ratings is to assist in the development of operating procedures for the identified Facilities in order to operate these Facilities in real-time while respecting any short term or Emergency Ratings of the most limiting Element without exceeding the next most limiting Element's thermal rating.

Ratings and procedures to revise ratings should be documented, and then included in the construction and maintenance processes. Change controls and data quality controls for the data management tools are recommended to ensure accurate ratings for the safe and reliable operation of the Bulk Electric System. These controls may consist of field audits or automated data checks to make sure accidental changes are not made. Ratings and rating changes need to be communicated to associated Reliability Coordinator(s), Planning Coordinator(s), Transmission Owner(s), Transmission Planner(s) and Transmission Operator(s)

R6 Application

R6. *Each Transmission Owner and Generator Owner* ***shall have Facility Ratings for its solely and jointly owned Facilities*** *that are* ***consistent with the associated Facility Ratings methodology*** *or documentation for determining its Facility Ratings. [Violation Risk Factor: Medium] [Time Horizon: Operations Planning]*

Using system schematics to identify and document each individual Element, which make up each BES Facility. Through the application of their methodology (R2 and R3) or application of the documentation (R1), the entity shall determine Ratings of each Element in the circuit. Once all series components making up each Facility is determined the applicable entity will have the necessary information to determine the overall Facility Rating. Both the Normal and Emergency Ratings shall be identified for those Elements, which have been identified in R2 and R3. Responsible entities may develop a database similar to the example in Figure 3 (page 12) which identifies all of the Elements in a circuit as well as the Facility Ratings.

In addition, responsible entities should develop a process which identifies all of those Facilities, which have joint ownership. Consideration should be given, but not limited to those Facilities':

- Interconnection points with adjacent owners
- Generator interconnections

Owners of jointly owned Facilities shall coordinate and document their Element Ratings with the other owners of the Facility in order to determine the overall Facility Rating.

Owners shall have each BES Facility Rating and should have the source documentation applied in the determination of the ratings of all Elements comprising a Facility to demonstrate it is *consistent with the associated Facility Ratings methodology*.

Source documentation may be, but not limited to:

- Manufacture rating of each Element

- Photos of nameplate rating of each Element
- Copies of calculations used in determination of Element Ratings
- Copies of industry ratings used for each Element
- Engineering drawings

The Ratings of each Facility should be maintained in a process that allows the entity to:

- Identify each BES Facility
- Identify the rating of each Element
- Identify the most limiting and the next most limiting Element identified by the owner
- Identify most limiting and the next most limiting Element identified by joint owner
- Identify the overall most limiting and the next most limiting Element overall determining the Facilities Normal and Emergency Ratings.

R7 Application

R7. *Each **Generator Owner shall provide Facility Ratings** (for its **solely and jointly** owned Facilities that are **existing** Facilities, **new** Facilities, **modifications** to existing Facilities and re-ratings of existing Facilities) to its associated Reliability Coordinator(s), Planning Coordinator(s), Transmission Planner(s), Transmission Owner(s) and Transmission Operator(s) **as scheduled** by such requesting entities. [Violation Risk Factor: Medium] [Time Horizon: Operations Planning]*

Generator Owners are required to provide their Facility Ratings to those associated entities which have a reliability need to have the GOs Facility Ratings. The Facility Ratings shall be provided as requested. Examples of ratings delivery methods include:

- Web tools,
- EMS model updates or
- Email.

Generator Owner should be prepared to provide appropriate schedules, and response transmittals or emails to and from appropriate Reliability Coordinators, Planning Coordinators, Transmission Planners, Transmission Owners, and Transmission Operators

R8 Application

R8. *Each Transmission Owner (and each Generator Owner subject to Requirement R2) **shall provide requested information** as specified below (for its **solely** and **jointly** owned Facilities that are **existing** Facilities, **new** Facilities, modifications to existing Facilities and re-ratings of existing Facilities) to its associated Reliability Coordinator(s), Planning Coordinator(s), Transmission Planner(s), Transmission Owner(s) and Transmission Operator(s): [Violation Risk Factor: Medium] [Time Horizon: Operations Planning]*

8.1. *As scheduled by the requesting entities:*

8.1.1. *Facility Ratings*

8.1.2. *Identify of the most limiting equipment of the Facilities*

*8.2. **Within 30 calendar days** (or a **later date if specified by the requester**), for any requested Facility with a Thermal Rating that limits the use of Facilities under the requester's authority by causing any of the following: 1) An Interconnection Reliability Operating Limit, 2) A limitation of Total Transfer Capability, 3) An impediment to generator deliverability, or 4) An impediment to service to a major load center:*

***8.2.1.** Identity of the existing next most limiting equipment of the Facility*

***8.2.2.** The Thermal Rating for the next most limiting equipment identified in Requirement R8, Part 8.2.1.*

In addition to submittal of Facility Ratings and identification of the most limiting Element TOs (and those GOs subject to R2) may also be required to provide the next most limiting equipment in the circuit and its Thermal Rating for any circuit that affects:

1) Interconnection Reliability Operating Limit (IROL)
2) A limitation of Total Transfer Capability
3) An impediment to generator deliverability, or
4) An impediment to service to a major load center

Responsible entities may elect to develop a four-position matrix with Normal and Emergency Ratings across one axis and criteria for identifying the most limiting Element and the Rating on another axis. An example would be if equipment has both Normal and Emergency Ratings such as a large power transformer. Owners may have different Normal and Emergency Ratings along with different seasonal Ratings.

	Normal Rating	Emergency Rating
Most Limiting Rating	500 MVA Summer 500 MVA Winter **Power Transformer**	750 MVA 750 MVA Winter **Power Transformer**
Next Most Limiting Rating	717 MVA for more than 1 hour Summer 717 MVA for more than 1-hour Winter **Breaker**	956 MVA Summer 956 MVA Winter **Switch**

As in R7, the owner should be prepared to provide appropriate schedules, and response transmittals or emails to and from appropriate Reliability Coordinators, Planning Coordinators, Transmission Planners, Transmission Owners, and Transmission Operators. "Associated" refers to those entities who jointly own facilities, owners of adjacent Facilities, and those entities that have been identified as the Reliability Coordinator, Transmission Planner and Planning Coordinator of those Facilities.

Revision History

Revision	Effective Date	Author(s)	Approver(s)	Summary of Changes
1.0	10/1/2015	SMET	MRO SC	Original Issue
1.1	3/21/2017	SMET	MRO SC	Page 11- replaced “should” with “shall
1.1	9/27/2017			Repaired hyperlink to FERC discussion

APPENDIX A: Recommended Management Practices

Disclaimer: Internal controls are voluntary and not mandatory. Recommendations made in this application guide are intended to demonstrate potential way(s) of approaching internal controls and are not all-inclusive.

Summary: Accurate Facility Ratings are essential in the development of System Operating Limits (SOL). Management practices are developed to ensure Facility Ratings are utilizing the correct equipment ratings, match field conditions, ensure the most limiting elements have been identified and a second independent review of the ratings has been conducted in order to validate derived Facility Rating.

Generic Examples of Best Practices:

Requirement 1: Identify documentation of equipment ratings used to develop the generator Facility Rating.

Measure: The entity should be able to verify that ratings documentation exists for each element at a generator facility:

- Use a table similar to figure 2 (page 8) to ensure all elements of the generator Facility are being considered.
- Review ownership documentation for establishing whether high side or low side bushings are the demarcation point for the generator Facility Rating.
- Develop a report to provide feedback.

Requirement 2 and 3: Develop a Facility Ratings Methodology.

Measure: The entity should be able to verify it has a facility ratings methodology that covers all equipment owned by the entity:

- Use a table similar to Figure 2 (page 8) to make sure all elements of the Facility are being considered in the methodology.
- Develop a report to provide feedback

Requirement 6: Develop a Facility Rating for each Facility.

Measures: The entity should be able to provide:

- Element ratings that make up each Facility Rating
- The most limiting Facility Rating
- The next most limiting Facility Rating, if applicable.
- Validation Facility Ratings are consistent with its methodology or documentation.

Examples of Internal Controls

(1) Develop processes and procedures to accomplish these measures which:

- Identify all BES Facilities
- Identify all elements that comprise each facility
- Be able to identify the source documentation for each element rating.
- Implement a system, spreadsheet, or one-line diagram able to reproduce the Element data for a given Facility demonstrating that the most limiting component was chosen
    - Identify the second most limiting element as requested
- Provides for notification of new facilities
- Provides for replacement of existing elements
- Provides for review of system changes on a periodic basis (such as sampling) to ensure all modifications to facilities have been reviewed
    - Provide a mechanism to make corrections to Facility Ratings when it is found that they are not consistent with the methodology.

(2) Provide for a second independent review (-peer review) to ensure the accuracy of the developed Facility Ratings

APPENDIX B: Frequently Asked Questions

1. What is acceptable for multiple components with the same Ratings? Are you to group like rated items together and treat them as one rated thing?

Example:

Switch 1 = 600 amps
CT1 = 600 amps
CT2 = 600 amps
Breaker = 1200 amps.

A. Is the most limiting Rating 600 amps and the next most limiting Rating also 600 amps?
B. Is the most limiting Rating 600 amps and the next most limiting Rating 1200 amps?

FAC-008-3 Subject Matter Expert Team Recommendation: Answer A. Series components of a Facility are individual and should not be grouped. Therefore, if two series components of a Facility have the same Rating, the most limiting and next most limiting Rating are the same.

2. Look closely at the word "or" in R6. Does "or" mean I need to provide a methodology and documentation or does it mean I can supply a methodology or documentation.

R6. *Each Transmission Owner and Generator Owner shall have Facility Ratings for its solely and jointly owned Facilities that are consistent with the associated Facility Ratings methodology or documentation for determining its Facility Ratings.*

FAC-008-3 Subject Matter Expert Team Recommendation: The use of the term "or" is in reference to R2 and R3 that requires the use of a Facility Ratings methodology while R1 requires the use of "documentation" in support of the Facility Rating.

3. What should I do about joint owned Facilities?

FAC-008-3 Subject Matter Expert Team Recommendation: Entities must consider all series components in determining a most limiting Rating. This requires coordination between owners to determine the most limiting Element.

Case 1 – Clearly divided facilities: Company 1 owns terminal A and line section up to structure X somewhere in the middle of the line. Company 2 owns terminal B and the remainder of the line section. Each entity must provide its most limiting line sag calculation and terminal equipment Ratings. All series Elements and their Ratings must be accounted for by both parties to determine the most limiting Element.

Case 2 – Undivided facilities: Company 1 owns an undivided 30% of a Facility from terminal A (and breaker A) to terminal B (and breaker B). Company 2 owns an undivided 70% of a Facility from terminal A (and breaker A) to terminal B (and breaker

B). Each entity must provide its most limiting line sag calculation and terminal equipment. All series components must be accounted for by both parties by coordinating ratings. An alternative would be for one entity may take complete responsibility as the Transmission Owner of the line.

In both cases, entities may wish to add foreign owned most limiting and next most limiting columns in their Ratings databases and / or calculations.

APPENDIX C: References

- Link to the **Standard FAC-008-3 – Facility Ratings**
- Link to the **NERC Standards Glossary**
- Link to reference of February 11, 2014 **FERC discussion**
- FERC order approving NERC standards for FAC-008-3 is **Docket No. RD11-10-000** approved on November 17, 2011.

APPENDIX D: Acronym List

CIGRE – International Council on Large Electric Systems

IEEE – Institute of Electrical and Electronic Engineers