NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Meeting Notes
Project 2016-04 Modifications to PRC-025-1

May 15-18, 2017

NERC
Atlanta, GA

Administrative

1. **Introductions**
   The meeting was brought to order by the chair, J. Schmall at 1:30 p.m. on Monday, May 15, 2017. J. Schmall provided the team with introductory remarks noting that the team would start with the Standards Authorization Request (SAR) items that should be straight forward and easiest to address. Participants were introduced and those in attendance were:

Name	Company	Member / Observer	In-person (IP) Remote (R)			
			5/15	5/16	5/17	5/18
John Schmall	Electric Reliability Council of Texas, Inc.	Chair	IP	IP	IP	IP
Mike Jensen	Pacific Gas and Electric Company	Vice Chair	IP	IP	IP	IP
Juan Alvarez	Caithness Energy	Member	R	R	R	R
S. Bryan Burch, P.E.	Southern Company	Member	IP	IP	IP	IP
Walter Campbell	NextEra Energy Resources, LLC	Member	IP	IP	IP	IP
Jason Espinosa	Seminole Electric Cooperative, Inc.	Member	IP	IP	IP	IP
Mike Jensen	Pacific Gas and Electric Company	Member	IP	IP	IP	IP
Charles Yeung	Southwest Power Pool, Inc.	Observer	IP	IP	IP	IP
Scott Barfield-McGinnis, Senior Standards Developer	North American Electric Reliability Corporation	Observer	IP	IP	IP	IP

Name	Company	Member / Observer	In-person (IP) Remote (R)			
			5/15	5/16	5/17	5/18
Soo Jin Kim	North American Electric Reliability Corporation	Observer	-	-	IP	-
Lauren Perotti, Counsel	North American Electric Reliability Corporation	Observer	R	R	R	R
Syed Ahmad	Federal Energy Regulatory Commission	Observer	IP	IP	IP	IP
Jamison Cawley	Nebraska Public Power District	Observer	-	-	R	-
Ben Davis	Vestas	Observer	R	R	R	R
Venona Greaff	Oxy	Observer	R	R	R	R
Terry Harbour	MidAmerican Energy	Observer	-	R	-	-
Eric Loiselle	Hydro Québec TransÉnergie	Observer	R	R	R	R
Si Truc Phan	Hydro Québec TransÉnergie	Observer	-	R	-	-
Rich Quest	Midwest Reliability Organization	Observer	-	-	R	-
Masoud Sharifi	Siemens Wind Power, Inc.	Observer	IP	IP	IP	IP
Phil Tatro	Energy Initiatives Group, LLC	Observer	-	-	-	R
Chuck Woods	MidAmerican Energy	Observer	R	R	R	R
Various Attendees	North American Generator Forum (Special Session)	Observer	-	-	-	R

2. **Determination of Quorum**
   The rule for NERC Standard Drafting Team (SDT or team) states that a quorum requires two-thirds of the voting members of the SDT. Quorum was achieved as all of the six members were present.

3. **NERC Antitrust Compliance Guidelines and Public Announcement**
   NERC Antitrust Compliance Guidelines and public announcement were read by S. Barfield-McGinnis. There were no questions raised.

4. **Roster Updates**
   The team did not review the team roster as no changes are occurred.

Notes

1. **Revise PRC-025-1**
   For SAR item #1, the team reviewed a presentation provided by M. Sharifi concerning the tripping of asynchronous generators. The team considered various issues, including the development of criteria that requires entities to set relays or tripping at a percentage below the performance of control based devices.

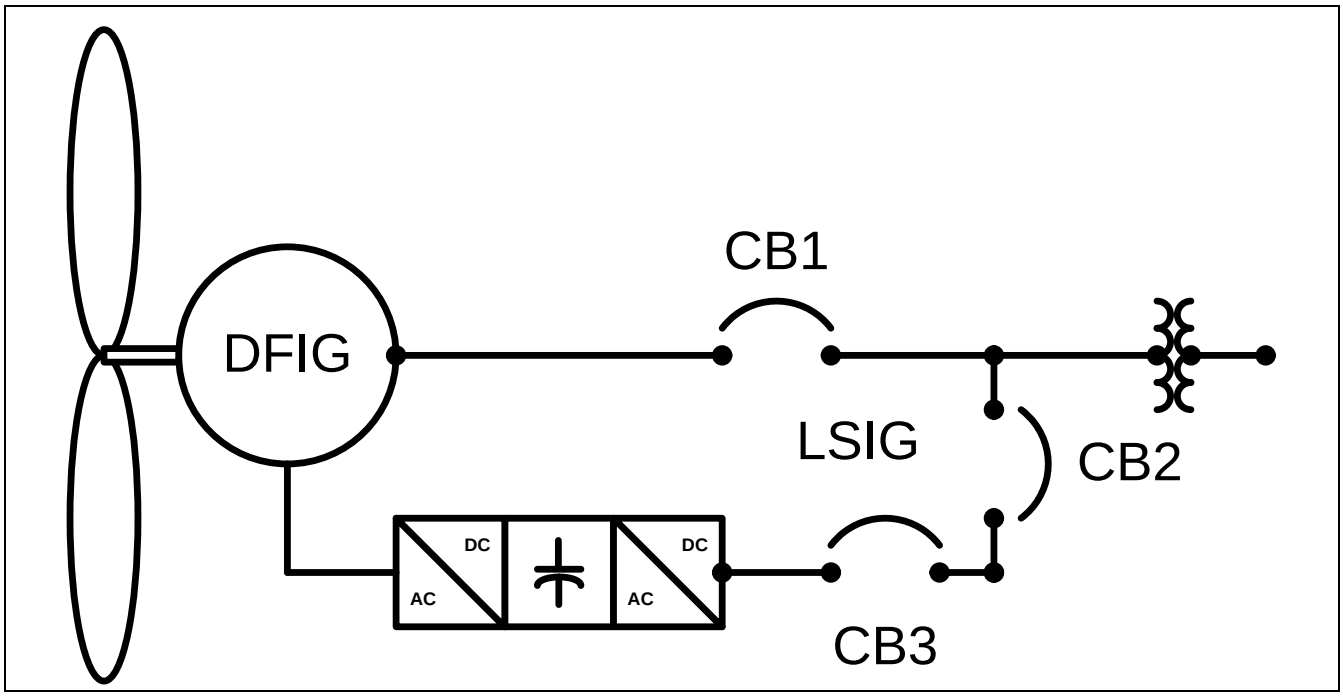
   M. Jensen summarized the issues and potential solutions from the various discussions:

   Tripping cannot be set at 130% due to equipment sizing/limitations at the generator.

   a. Solution A: Due to equipment limitation of the low voltage circuit breakers are exempt.
   b. Solution B: Show proof the equipment can reach its capability without reaching the trip limit of the protective element/device. (Specify margin?)
   c. Solution C: Due to equipment limitation of the low voltage circuit breakers currently, require inclusion after a certain date to allow manufacturers to adjust to standard.

   S. Burch highlighted to the team that many inverter collector system installations are designed with no excessive margins over the aggregate rated output of the resources.

   W. Campbell raised a concern to the team about DFIG wind resources where there are multiple low voltage circuit breakers (e.g., CB1, CB2, and CB3). In this case, CB1 sees stator current and CB2 sees rotor current and auxiliary loads. Apparently, some manufactures provide nameplate ratings for both stator and rotor output, where others only a total output. The circuit breaker CB3 sees current being delivered to inverter power loads and the rotor; however, during super-synchronous conditions, the rotor will produce a current to the grid. The team discussed the potential for interdependency between PRC-025, PRC-019, and PRC-024. Most agreed that PRC-024 (*Generator Frequency and Voltage Protective Relay Settings*) would not apply in the wind case because the voltage inputs are used by the control system and not the protective system. However, the team was unsure whether the low voltage equipment is applicable to PRC-019 (*Coordination of Generating Unit or Plant Capabilities, Voltage Regulating Controls, and Protection*).



The team concurred that offering an alternative to the 130% margin criteria was necessary, agreeing to "[t]he protection element shall not infringe upon the resource capability (including the Mvar output of any static or dynamic reactive power devices) with worst case documented tolerances applied between equipment capability and the protection element (see Figure A)." Also, the team agreed that deleting the term "transformer" in Exclusion #7 will make it clear that if the generator capability infringed on the protection element after 15 minutes (900 seconds) it would not be subject to the standard. Only the time less than 900 seconds is within the purview of Option 5b for asynchronous generators.

The team addressed SAR item #2 concerning the potential for Generator Owners to apply a pickup setting of the 50 element (i.e., instantaneous overcurrent) of a Protection System, which is not applicable to the standard. It is possible this may result in a lower setting than the minimum pick up established by the standard for the 51 element (i.e., time delayed overcurrent). To correct, the team revised the locations with "50" with "(e.g., 50, 51, or 51V-R)." This clarifies that the relay type is "Phase Overcurrent," and for example, includes the 50, 51, or 51V-R IEEE device numbers.

The team addressed item #3 concerning the use of "or" in the application column of Table 1 by replacing "or" with "including" resulting in "…including Elements utilized in the aggregation of dispersed power producing resources." This affected Table 1 options 1, 2, and 3.

For SAR item #4, E. Loiselle from HydroQuébec TransÉnergie (HQTE) provided a presentation to attendees on the issue of weak generation that is significantly remote to a strong transmission system. He started by showing a map of the Quebec transmission topology of 735 kV facilities to the north of the Montreal load center and 735 to the northeast. The issue was revealed in the generators

connected at 315 kV to the 735 kV on facilities to the northeast. The presentation included demonstrating the reactive power output (Q) based upon simulation and power flow equations. The simulation resulted in significantly lower percentage of Q being transferred due to using a shunt reactor in the model to produce the 0.85 per unit (pu) voltage depression. The shunt absorbed significant amounts of Q and notes that the standard does not provide a methodology for modeling. The power flow equations resulted in a higher level of Q being transferred, but less than what was anticipated by the standard at the generating plant. J. Schmall summarized that potential solutions could be: 1) a variance for HQTE, 2) appending new application or option(s) in Table 1, or 3) address it from an equipment limitation standpoint (e.g., 115% or 130% margin).

Through discussion with P. Tatro, the team concurred that the HQTE equation is a steady-state equation that excludes the forcing function; therefore, would not address the concerns of the standard. However, the 0.85 pu voltage at the remote end of the line (i.e., transmission substation) is a valid scenario for determining the relay setting. Table 1, Option 14b was modified to accommodate this scenario (i.e., radial line impedance).

For SAR item #5, the team decided to eliminate the term "Pickup" from the uses of "Pickup Setting Criteria." The team concluded that the term "Pickup" did not add any value while considering phrases like "operational time." The phrase "operational time" was not used because it could bring into question the operating time of the relay logic and create questions of measurability and compliance.

The team address SAR item #6a by appending the applicable IEEE references[1] to the Associated Documents section of the standard. Revisions also included adding language to highlight that manufacturers also include protective device trip unit designations for long-time delay, short-time delay, and instantaneous (e.g., L, S, and I).

Item #6b of the SAR was addressed by deleting the clause "however, do not have excitation systems and" under the Application Guidelines, Asynchronous Generator Performance section. The team agreed that an asynchronous machine that is behind an inverter is correctly classified under Table 1, Options 4, 5, and 6 in the use of "(including inverter-based installations)" in the Application column, for example. Further, the team additionally concluded that a synchronous machine (i.e., Type 4) behind an inverter is not synchronous because it has slip and is not operating synchronously with the bulk power system.

For SAR item #6c, the team revised the Generator section to include language to highlight that if different seasonal capabilities are reported, the maximum capability shall be used for the purposes of this standard as a minimum requirement. The Generator Owner may base settings on a capability that is higher than what is reported to the Transmission Planner for either synchronous or asynchronous generation.

[1] IEEE C37.17-2012, "IEEE Standard for Trip Systems for Low-Voltage (1000 V and below) AC and General Purpose (1500 V and below) DC Power Circuit Breakers" and IEEE C37.2-2008, "IEEE Standard for Electrical Power System Device Function Numbers, Acronyms, and Contact Designations"

The team addressed SAR item 6d concerning Figure 1, CB103 by revising the figure to extend the purview of PRC-025-1 to CB103. Additionally, the team modified Table 1 to make clear that the relay for CB103 is applicable depending on the application (i.e., remote end of the line). The team considered the 0.85 pu voltage at bus b (see Figures 1 and 2 in the Standard).

The team held a special session to engage members of the North American Generator Forum. To start, T. Harbour raised a question about zero-defect compliance where Facilities may have many resources, but one or two are substantively different and the entity happens to fail to demonstrate compliance. S. Barfield-McGinnis noted that while the team understands the benefit and noted that this would best be handled by in the compliance enforcement space and would probably result in a little or none penalty depending on the facts and circumstances.

A question was raised by W. Gross about the application of fuses on unit auxiliary transformers (UAT). The standard is silent in Table 1, Application for the UAT. S. Barfield-McGinnis asked W. Gross to send him a problem statement for each of the issues and the potential approaches to resolving the issue. The team reviewed the following issues:

> For example: PRC-025 studies have identified several BES facility's that show the high side overcurrent is not in compliance with the standard. At these sites, the high side overcurrent is coordinating with the low side overcurrent. The low side overcurrent is set above the 135% recommended minimum of the UAT nameplate referenced in the conclusions of the SPCS UAT document.
>
> Also, consider a new option (perhaps 13c) with criteria that states:
>
> > Where there is only one UAT low side protective device that is set at a minimum 135% of the UAT nameplate or 135% or greater than load operating at .85 per unit voltage, the UAT high side protective device must be set equal to or coordinate with the low side protective device.
> >
> > Second, several BES UAT's with high side fuses that will operate at less than 150% UAT ratings; therefore, UAT fusing should be considered in the relay type category.

The team concurred that low-side protection should not be included in the standard. However, fusing is currently not applicable to the standard, but may need to be considered. S. Barfield-McGinnis took an action item to review with NERC staff for feedback.

2. Next steps – reviewed by J. Schmall

- M. Jensen will prepare the calculations for Option 14b.
- S. Barfield-McGinnis will update the relays in Figures 3-6 from 51 to 50/51.
- S. Barfield also covered the schedule with the team and there we no objections.

- S. Barfield will circulate the draft standard to the MRO NSRF.

3. Future meeting(s)

- Quality Review Conference Call – Wednesday, May 31, 2017 from 1:00-2:30 p.m. Eastern.
- NAGF SRT WebEx – Wednesday, June 7, 2017, 11:00 a.m.-12:00 p.m. Eastern.
- Industry Webinar – Wednesday, June 7, 2017, 12:30-2:00 p.m. Eastern (SDT members login at 12:00 p.m. Eastern, following NAGF SRT call).

4. Adjourn

Meeting adjourned 3:36 p.m. Eastern, Thursday, May 18, 2017.