

Technical Rationale

Project 2020-02 Modifications to PRC-024 (Generator Ride-through)

PRC-024-4 – Frequency and Voltage Protection Settings for Synchronous Generators and Synchronous Condensers

General Rationale

The drafting team proposes to modify PRC-024-3 to retain the Reliability Standard as a protection-based standard with applicability to only synchronous generators and synchronous condensers. This proposal is a consequence of both the different natures of synchronous and inverter-based generation resources and several recent events exhibiting significant IBR ride-through deficiencies. The behavior of rotating synchronous generators during faults and other disturbances on the transmission system is well established and understood in comparison to IBR generation. The disturbance ride-through vulnerabilities of synchronous generators are pole slipping instability and undervoltage dropout of critical plant auxiliary equipment, leading to tripping of a generator. Pole slipping can be managed by active power dispatch and system condition constraints, and is outside the scope of PRC-024-3. Undervoltage dropout of critical auxiliary equipment is also outside the scope of PRC-024-3 because of complexities associated with auxiliary systems and how such equipment behaves under low voltage conditions.

The Project 2020-02 Standard Authorization Request (SAR) notes that auxiliary equipment has not posed a ride-through risk and the SAR specifically excludes modifications in PRC-024-3 for auxiliary equipment. Over-frequency protection, under-frequency protection, and voltage protection may or may not be applied to synchronous generating units. If applied however, settings should be coordinated between the needs of generating unit protection, reasonable expected excursions of system frequency and voltage in a straightforward fashion, e.g., as no-trip zones within PRC-024-3 attachments, as well as the coordination of generating unit capabilities, voltage regulating controls, and protection within PRC-019-2. Excitation and governing controls affect synchronous generator ride-through behavior to some degree but because of progressive improvement, standardization, and level of maturity of these controls, they are rarely if ever cause unnecessary tripping during disturbances.

In addition, there are other existing NERC standards to prevent unnecessary tripping of the generators during a system disturbance such as PRC-025-2 “Generator Relay Loadability”, and PRC-026-2 “Relay Performance During Stable Power Swings”. For these reasons, there is no need to impose actual disturbance ride-through requirements on synchronous units and only include restrictions for frequency and voltage protection setting ranges as maintained in PCR-024-4.

Rationale for Applicability Section (4.0)

Functional Entities (4.1)

The functional entity responsible for setting frequency, voltage, and volts per hertz protection for synchronous generators and synchronous condensers is the Generator Owner (GO) and Transmission

Owner (TO). Planning Coordinators (PC) are also retained as applicable entities but are only in the Quebec Interconnection. Modifications are proposed in PRC-024-4 to expand functional entity applicability to include those Transmission Owners that apply protection, as listed in new Facility applicability section 4.2.2.

Facilities (4.2)

Applicability Facilities subparts in Section 4.1.1 were modified to restrict PRC-024-4 to synchronous generators. Section 4.2.2 was added as new subparts to identify which synchronous condensers and equipment.

Rationale for Requirements R1 through R4

Modifications were made to Requirements R1, R2, R3, and R4 to include the Transmission Owner as a functional entity applicable to each requirement.

Modifications were made to Requirements R1, R2, R3, and R4 to include language for synchronous condensers and to remove language that relates to inverter-based resource functionality (i.e., “cease injecting current”).