

Company: General Electric

Technologies analyzed: synchronous generators and power park modules

Comments on "PROPOSAL FOR NC RFG REQUIREMENTS OF GENERAL APPLICATION"

BLUE → PPM

3.1.4 LFSM-O: would recommend to take off the „for power increase“ section in the Tables.

3.1.5: Introduces the transient and steady-state time domains for the power reduction versus falling frequency. Could be good to have more detailed definitions on these timeframes

4.3.1 reactive power capabilities: the minimum power seen in figure 7 can be an issue depending on the technology. Either add a comment that it's those values or the technical minimum, or add a "technical minimum" line in the figure.

4.3.1: we understand this item is not applicable to Type D units connected via a step-up transformer
→ Confirm

4.3.3 FRT SPMG: all parameters for calculations SHOULD be stated here. Otherwise it's too difficult to understand (via simulations) if the units can withstand the desired FRTs. We recommend full power, most underexcited operation, 1 p.u. voltage at PoC, and short circuit power at the point of connection 5 times the nominal size (in MVA) of the plant or 100 MVA, whichever is greater.

Section 4.3.4 post fault active power recovery: we propose to increase 3 seconds to 5 seconds, or add a comment similar to the following: "For the purposes of compliance with this requirement in the case that the response in active power is oscillating, the trend line of the non-oscillating component of the active power will be considered after the clearance of the fault. Additionally, the oscillation must present a damping greater than 10%."; this will allow units that have a small oscillating behavior after a fault to comply with the requirement.

4.4.1. FRT - PPM

Requirement : "This requirement should be met at the connection point"

Comment: Certification is done at WTG terminals according to IEC certification standard (IEC). Clear specification from ELIA on how is going to be verified the compliance of this requirement at POC is required. If a simulation is required, please detail tests required, acceptance criteria and stage at which is required. If turbine IEC certification is enough please state that.

4.4.2. Reactive capabilities - PPM

Requirement : "The unit is therefore expected to not limits its capabilities to comply with the minimum requirement..."

Comment: By unit it is meant PPM module or turbine modules? Park controllers normally incorporate max/min limits at POC to not accept unrealistic values from customers or TSO, so which limits should be applied at park controller (+-0.95PF) as defined in the requirement or higher values (0.9PF,0.8PF) ... to not limit capability?

Additionally, how will the maximum capabilities of the PPM be verified? Typically, at commissioning tests for park controller are performed to demonstrate the GC capability (e.g. +-0.95PF at POC) not further than that.

4.4.3. Fault current & dynamic voltage support - PPM

Requirement : "...inject/absorb additional reactive current... function of the positive sequence voltage at the connection point"

Comment: Under normal voltage ranges voltage control is performed via park controller. Time response for voltage control according to EU 2016/631 is under 5 sec.

However, fault current contribution point is done at unit (turbine) terminals. No time responses for fault current contribution is specified. Typically, response time of 110ms (delay 20ms+rise 30ms+settling 60ms) in German VDE regulation is considered for that control at turbine terminals, which besides it also see a different voltage level than POC. So, it makes no sense to mix both requirements:

a) voltage regulation at POC

b) additional reactive current injection at unit (turbine) terminals level

In addition, certification of the fault current requirement is typically as well done at WTG terminals.

Requirement : “For the reliable detection of asymmetric faults, the PPM unit shall contribute to the fault with positive, negative and zero-sequence current”

Comment: Clear definition of contribution of negative and zero-sequence current is required from ELIA. Additional injection of reactive current according to Fig. 13 is done at WTG terminals, which is performed even in case of asymmetrical faults at POC due to different vector groups and translation of asymmetrical faults at WTG terminals.

5.1.1: Could be good to have an idea of the expected range for the tolerance requirements.

5.1.2: Is power decrease applicable to FLSM-U, as mentioned in the tables?

5.1.3 FSM: the definition of droop given in the table can be confusing. Is the droop a settable parameter, or must it be automatically changed based on the active power range and maximum activation frequency (200 mHz)? This would imply a calculation needed from the unit, and not a direct droop parameter.

5.2.1: Islanding operation is not applicable to Type C units. What about the Type D units ?

5.3.3: more details on the simulation models would be useful

5.3.3. Simulation models

Requirement : “...A model to represent Electro Magnetic Transient phenomena can be required on a site specific base for every concerned unit”

Comment: Load flow/RMS models type (IEC, manufacturers..), SW format and validation/acceptance criteria should be clearly defined before even before of the connection process for OEM preparation of those models on a country based approach, otherwise it may not be available upon certain formats due to the long time development and validation.

Additionally, for EMT models general typical requested format should be clarified in the grid code requirements, as well as the validation and acceptance criteria of those models. As well, if those models are related to plant or units, and the availability to submit those to TSO/DSO directly by OEM via specific NDA. Turbine EMT models include turbine IP (converter controls, turbine controls...) and can only be share black-boxed and/or with a clearly defined NDA directly with TSO/DSO.

5.4: It is not absolutely clear if this applies to Type D units also. In the Germany new Connection Conditions this functionality is not required for units connected to the 380 kV system

5.5.1 Type C reactive power capability SPMG: in Figure 17 it can be seen that the units need to accept a voltage up to 1.118 p.u.; will this be seen directly at the generator terminals? Does it imply that a transformer would be in the middle and this 1.118 be only seen at higher (>36 KV) level? Having generators face voltages above 1.10 p.u. is outside standard products, which will have a direct impact on final price.

5.6.1. Synthetic inertia - PPM

Requirement : "...not required for the current GC implementation due to low maturity..."

Comment: Synthetic inertia is currently available for manufacturers of wind turbines. If no remuneration is defined by TSO (via mandatory requirement or ancillary service), no customers will invest/purchase this functionality from OEM. One example is Ireland, where this is included as ancillary services (DS3) and some manufactures has passed the tests and acceptance criteria of such functionality.

5.6.2. Reactive capabilities - PPM

Requirement : "Fig 19. ... 90%-111.8% voltage capability with $Q=+35\%P_{max}$ to $Q=-30\%P_{max}$..."

Comment1: Why is requesting ELIA for PPM a square U/Q characteristic differently to what is being requested to SPGM? Is there really a need to provide reactive power at 1.118pu voltages and absorb reactive power at 0.9pu voltage?

Comment2: Steady state voltages at POC (e.g. 111.8pu) while providing steady-state reactive power ($Q=+0.35P_{max}$) can only be obtained due to OLTC regulation to adjust voltages at MV buses. Turbines will be saturated due to the high voltages at turbine terminals and reactive power capability will be very limited, which only by OLTC actuation to brought back the voltage at MV bus will allow turbines deliver full Fig 18 capability.

Comment3: Substation transformer OLTC operation is very slow compared with the required time responses under few seconds (exhaustive) when operating on voltage control mode. Therefore fulfillment of Figure19 is not realistic on voltage control mode with OLTC.

6.3.1 Suggest to give more details on the 'pre and post fault short circuit capacity, pre-fault operating point of the PGM...'. For example, the minimum SC level versus the installed capacity as will be supported by the Grid; the reactive operating conditions, etc.