

Commission Regulation (EU) 2016/631 of 14 April 2016 establishing a network code on requirements for grid connection of generators (Text with EEA relevance)

TITLE IV

**COMPLIANCE**

CHAPTER I

***Compliance monitoring***

*Article 40*

**Responsibility of the power-generating facility owner**

1 The power-generating facility owner shall ensure that each power-generating module complies with the requirements applicable under this Regulation throughout the lifetime of the facility. For type A power-generating modules, the power-generating facility owner may rely upon equipment certificates, issued as per Regulation (EC) No 765/2008.

2 The power-generating facility owner shall notify to the relevant system operator any planned modification of the technical capabilities of a power-generating module which may affect its compliance with the requirements applicable under this Regulation, before initiating that modification.

3 The power-generating facility owner shall notify the relevant system operator of any operational incidents or failures of a power-generating module that affect its compliance with the requirements of this Regulation, without undue delay, after the occurrence of those incidents.

4 The power-generating facility owner shall notify the relevant system operator of the planned test schedules and procedures to be followed for verifying the compliance of a power-generating module with the requirements of this Regulation, in due time and prior to their launch. The relevant system operator shall approve in advance the planned test schedules and procedures. Such approval by the relevant system operator shall be provided in a timely manner and shall not be unreasonably withheld.

5 The relevant system operator may participate in such tests and record the performance of the power-generating modules.

*Article 41*

**Tasks of the relevant system operator**

1 The relevant system operator shall assess the compliance of a power-generating module with the requirements applicable under this Regulation, throughout the lifetime of the power-generating facility. The power-generating facility owner shall be informed of the outcome of this assessment.

For type A power-generating modules, the relevant system operator may rely upon equipment certificates issued by an authorised certifier for this assessment.

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2 The relevant system operator shall have the right to request that the power-generating facility owner carry out compliance tests and simulations according to a repeat plan or general scheme or after any failure, modification or replacement of any equipment that may have an impact on the power-generating module's compliance with the requirements of this Regulation.

The power-generating facility owner shall be informed of the outcome of those compliance tests and simulations.

3 The relevant system operator shall make publicly available a list of information and documents to be provided as well as the requirements to be fulfilled by the power-generating facility owner within the framework of the compliance process. The list shall cover at least the following information, documents and requirements:

- a all the documentation and certificates to be provided by the power-generating facility owner;
- b details of the technical data on the power-generating module of relevance to the grid connection;
- c requirements for models for steady-state and dynamic system studies;
- d timeline for the provision of system data required to perform the studies;
- e studies by the power-generating facility owner to demonstrate the expected steady-state and dynamic performance in accordance with the requirements set out in Chapters 5 and 6 of Title IV;
- f conditions and procedures, including the scope, for registering equipment certificates; and
- g conditions and procedures for the use of relevant equipment certificates issued by an authorised certifier by the power-generating facility owner.

4 The relevant system operator shall make public the allocation of responsibilities between the power-generating facility owner and the system operator for compliance testing, simulation and monitoring.

5 The relevant system operator may totally or partially delegate the performance of its compliance monitoring to third parties. In such cases, the relevant system operator shall continue ensuring compliance with Article 12, including entering into confidentiality commitments with the assignee.

6 If compliance tests or simulations cannot be carried out as agreed between the relevant system operator and the power-generating facility owner due to reasons attributable to the relevant system operator, then the relevant system operator shall not unreasonably withhold the operational notification referred to in Title III.

#### *Article 42*

### **Common provisions for compliance testing**

1 Testing of the performance of individual power-generating modules within a power-generating facility shall aim at demonstrating that the requirements of this Regulation have been complied with.

2 Notwithstanding the minimum requirements for compliance testing set out in this Regulation, the relevant system operator is entitled to:

- a allow the power-generating facility owner to carry out an alternative set of tests, provided that those tests are efficient and suffice to demonstrate that a power-generating module complies with the requirements of this Regulation;

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- b require the power-generating facility owner to carry out additional or alternative sets of tests in those cases where the information supplied to the relevant system operator in relation to compliance testing under the provisions of Chapter 2, 3 or 4 of Title IV, is not sufficient to demonstrate compliance with the requirements of this Regulation; and
- c require the power-generating facility owner to carry out appropriate tests in order to demonstrate a power-generating module's performance when operating on alternative fuels or fuel mixes. The relevant system operator and the power-generating facility owner shall agree on which types of fuel are to be tested.

3 The power-generating facility owner is responsible for carrying out the tests in accordance with the conditions laid down in Chapters 2, 3 and 4 of Title IV. The relevant system operator shall cooperate and not unduly delay the performance of the tests.

4 The relevant system operator may participate in the compliance testing either on site or remotely from the system operator's control centre. For that purpose, the power-generating facility owner shall provide the monitoring equipment necessary to record all relevant test signals and measurements as well as ensure that the necessary representatives of the power-generating facility owner are available on site for the entire testing period. Signals specified by the relevant system operator shall be provided if, for selected tests, the system operator wishes to use its own equipment to record performance. The relevant system operator has sole discretion to decide about its participation.

### *Article 43*

#### **Common provisions on compliance simulation**

1 Simulation of the performance of individual power-generating modules within a power-generating facility shall aim at demonstrating that the requirements of this Regulation have been fulfilled.

2 Notwithstanding the minimum requirements set out in this Regulation for compliance simulation, the relevant system operator may:

- a allow the power-generating facility owner to carry out an alternative set of simulations, provided that those simulations are efficient and suffice to demonstrate that a power-generating module complies with the requirements of this Regulation or with national legislation; and
- b require the power-generating facility owner to carry out additional or alternative sets of simulations in those cases where the information supplied to the relevant system operator in relation to compliance simulation under the provisions of Chapter 5, 6 or 7 of Title IV, is not sufficient to demonstrate compliance with the requirements of this Regulation.

3 To demonstrate compliance with the requirements of this Regulation, the power-generating facility owner shall provide a report with the simulation results for each individual power-generating module within the power-generating facility. The power-generating facility owner shall produce and provide a validated simulation model for a given power-generating module. The scope of the simulation models is set out in point (c) of Article 15(6).

4 The relevant system operator shall have the right to check that a power-generating module complies with the requirements of this Regulation by carrying out its own compliance simulations based on the provided simulation reports, simulation models and compliance test measurements.

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5 The relevant system operator shall provide the power-generating facility owner with technical data and a simulation model of the network, to the extent necessary to carry out the requested simulations in accordance with Chapter 5, 6 or 7 of Title IV.

## CHAPTER 2

### **Compliance testing for synchronous power-generating modules**

#### *Article 44*

#### **Compliance tests for type B synchronous power-generating modules**

1 Power-generating facility owners shall undertake LFSM-O response compliance tests in relation to type B synchronous power-generating modules.

Instead of carrying out the relevant test, power-generating facility owners may rely upon equipment certificates issued by an authorised certifier to demonstrate compliance with the relevant requirement. In such a case, the equipment certificates shall be provided to the relevant system operator.

- 2 The following requirements with regard to the LFSM-O response test shall apply:
- a the power-generating module's technical capability to continuously modulate active power to contribute to frequency control in case of any large increase of frequency in the system shall be demonstrated. The steady-state parameters of regulations, such as droop and deadband, and dynamic parameters, including frequency step change response shall be verified;
  - b the test shall be carried out by simulating frequency steps and ramps big enough to trigger at least 10 % of maximum capacity change in active power, taking into account the droop settings and the deadband. If required, simulated frequency deviation signals shall be injected simultaneously at both the speed governor and load controller of the control systems, taking into account the scheme of those control systems;
  - c the test shall be deemed successful if the following conditions are fulfilled:
    - (i) the test results, for both dynamic and static parameters, meet the requirements set out in Article 13(2); and
    - (ii) undamped oscillations do not occur after the step change response.

#### *Article 45*

#### **Compliance tests for type C synchronous power-generating modules**

1 In addition to the compliance tests for type B synchronous power-generating modules described in Article 44, power-generating facility owners shall undertake the compliance tests set out in paragraphs 2, 3, 4 and 6 of this Article in relation to type C synchronous power-generating modules. Where a power-generating module provides black start capability, power-generating facility owners shall also undertake the tests referred to in paragraph 5. Instead of the relevant test, the power-generating facility owner may use equipment certificates issued by an authorised certifier to demonstrate compliance with the relevant requirement. In that case, the equipment certificates shall be provided to the relevant system operator.

- 2 The following requirements with regard to the LFSM-U response test shall apply:

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- a it shall demonstrate that the power-generating module is technically capable of continuously modulating active power at operating points below maximum capacity to contribute to frequency control in case of a large frequency drop in the system;
  - b the test shall be carried out by simulating appropriate active power load points, with low frequency steps and ramps big enough to trigger active power change of at least 10 % of maximum capacity, taking into account the droop settings and the deadband. If required, simulated frequency deviation signals shall be injected simultaneously into both the speed governor and the load controller references;
  - c the test shall be deemed successful if the following conditions are fulfilled:
    - (i) the test results, for both dynamic and static parameters, comply with point (c) of Article 15(2); and
    - (ii) undamped oscillations do not occur after the step change response.
- 3 The following requirements with regard to the FSM response test shall apply:
- a it shall demonstrate that the power-generating module is technically capable of continuously modulating active power over the full operating range between maximum capacity and minimum regulating level to contribute to frequency control. The steady-state parameters of regulations, such as droop and deadband and dynamic parameters, including robustness through frequency step change response and large, fast frequency deviations shall be verified;
  - b the test shall be carried out by simulating frequency steps and ramps big enough to trigger the whole active power frequency response range, taking into account the settings of droop and deadband, as well as the capability to actually increase or decrease active power output from the respective operating point. If required, simulated frequency deviation signals shall be injected simultaneously into the references of both the speed governor and the load controller of the unit or plant control system;
  - c the test shall be deemed successful if the following conditions are fulfilled:
    - (i) the activation time of full active power frequency response range as a result of a frequency step change is no longer than required by point (d) of Article 15(2);
    - (ii) undamped oscillations do not occur after the step change response;
    - (iii) the initial delay time complies with point (d) of Article 15(2);
    - (iv) the droop settings are available within the range specified in point (d) of Article 15(2) and the deadband (threshold) is not higher than the value specified in that Article; and
    - (v) the insensitivity of active power frequency response at any relevant operating point does not exceed the requirements set out in point (d) of Article 15(2).
- 4 With regard to the frequency restoration control test the following requirements shall apply:
- a the power-generating module's technical capability to participate in frequency restoration control shall be demonstrated and the cooperation of FSM and frequency restoration control shall be checked;
  - b the test shall be deemed successful if the results, for both dynamic and static parameters, comply with the requirements of point (e) of Article 15(2).
- 5 With regard to the black start capability test the following requirements shall apply:

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- a for power-generating modules with black start capability, this technical capability to start from shut down without any external electrical energy supply shall be demonstrated;
  - b the test shall be deemed successful if the start-up time is kept within the time frame set out in point (iii) of Article 15(5)(a).
- 6 With regard to the tripping to houseload test the following requirements shall apply:
- a the power-generating modules' technical capability to trip to and stably operate on house load shall be demonstrated;
  - b the test shall be carried out at the maximum capacity and nominal reactive power of the power-generating module before load shedding;
  - c the relevant system operator shall have the right to set additional conditions, taking into account point (c) of Article 15(5);
  - d the test shall be deemed successful if tripping to house load is successful, stable houseload operation has been demonstrated in the time period set out in point (c) of Article 15(5) and re-synchronisation to the network has been performed successfully.
- 7 With regard to the reactive power capability test the following requirements shall apply:
- a the power-generating module's technical capability to provide leading and lagging reactive power capability in accordance with points (b) and (c) of Article 18(2) shall be demonstrated;
  - b the test shall be deemed successful if the following conditions are fulfilled:
    - (i) the power-generating module operates at maximum reactive power for at least one hour, both leading and lagging, at:
      - minimum stable operating level,
      - maximum capacity, and
      - an active power operating point between those maximum and minimum levels;
    - (ii) the power-generating module's capability to change to any reactive power target value within the agreed or decided reactive power range shall be demonstrated.

#### *Article 46*

### **Compliance tests for type D synchronous power-generating modules**

1 Type D synchronous power-generating modules are subject to the compliance tests for type B and C synchronous power-generating modules described in Articles 44 and 45.

2 Instead of the relevant test, the power-generating facility owner may use equipment certificates issued by an authorised certifier to demonstrate compliance with the relevant requirement. In such a case, the equipment certificates shall be provided to the relevant system operator.

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## CHAPTER 3

### **Compliance testing for power park modules**

#### *Article 47*

#### **Compliance tests for type B power park modules**

1 Power-generating facility owners shall undertake LFSM-O response compliance tests in relation to type B power park modules.

Instead of the relevant test, the power-generating facility owner may use equipment certificates issued by an authorised certifier to demonstrate compliance with the relevant requirement. In that case, the equipment certificates shall be provided to the relevant system operator.

2 With regard to type B power park modules, the LFSM-O response tests shall reflect the choice of control scheme selected by the relevant system operator.

3 With regard to the LFSM-O response tests the following requirements shall apply:

- a the power park module's technical capability to continuously modulate active power to contribute to frequency control in case of increase of frequency in the system shall be demonstrated. The steady-state parameters of regulations, such as droop and deadband, and dynamic parameters shall be verified;
- b the test shall be carried out by simulating frequency steps and ramps big enough to trigger at least 10 % of maximum capacity change in active power, taking into account the droop settings and the deadband. To perform this test simulated frequency deviation signals shall be injected simultaneously into the control system references;
- c the test shall be deemed successful in the event that the test results, for both dynamic and static parameters, comply with the requirements set out in Article 13(2).

#### *Article 48*

#### **Compliance tests for type C power park modules**

1 In addition to the compliance tests for type B power park modules described in Article 47, power-generating facility owners shall undertake the compliance tests set out in paragraphs 2 to 9 in relation to type C power park modules. Instead of the relevant test, the power-generating facility owner may use equipment certificates issued by an authorised certifier to demonstrate compliance with the relevant requirement. In such a case, the equipment certificate shall be provided to the relevant system operator.

2 With regard to the active power controllability and control range test the following requirements shall apply:

- a the power park module's technical capability to operate at a load level below the setpoint set by the relevant system operator or the relevant TSO shall be demonstrated;
- b the test shall be deemed successful if the following conditions are fulfilled:
  - (i) the load level of the power park module is kept below the setpoint;
  - (ii) the setpoint is implemented according to the requirements laid down in Article 15(2)(a); and

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- (iii) the accuracy of the regulation complies with the value specified in point (a) of Article 15(2).
- 3 With regard to the LFSM-U response test the following requirements shall apply:
  - a the power park module's technical capability to continuously modulate active power to contribute to frequency control in case of a large frequency drop in the system shall be demonstrated;
  - b the test shall be carried out by simulating the frequency steps and ramps big enough to trigger at least 10 % of maximum capacity active power change with a starting point of no more than 80 % of maximum capacity, taking into account the droop settings and the deadband;
  - c the test shall be deemed successful if the following conditions are fulfilled:
    - (i) the test results, for both dynamic and static parameters, comply with the requirements laid down in Article 15(2)(c); and
    - (ii) undamped oscillations do not occur after the step change response.
- 4 With regard to the FSM response test the following requirements shall apply:
  - a the power park module's technical capability to continuously modulate active power over the full operating range between maximum capacity and minimum regulating level to contribute to frequency control shall be demonstrated. The steady-state parameters of regulations, such as insensitivity, droop, deadband and range of regulation, as well as dynamic parameters, including frequency step change response shall be verified;
  - b the test shall be carried out by simulating frequency steps and ramps big enough to trigger the whole active power frequency response range, taking into account the droop settings and the deadband. Simulated frequency deviation signals shall be injected to perform the test;
  - c the test shall be deemed successful if the following conditions are fulfilled:
    - (i) the activation time of the full active power frequency response range as a result of a frequency step change is no longer than that required by point (d) of Article 15(2);
    - (ii) undamped oscillations do not occur after the step change response;
    - (iii) the initial delay is in line with point (d) of Article 15(2);
    - (iv) the droop settings are available within the ranges specified in point (d) of Article 15(2) and the deadband (threshold) is not higher than the value chosen by the relevant TSO; and
    - (v) the insensitivity of active power frequency response does not exceed the requirement set out in point (d) of Article 15(2).
- 5 With regard to the frequency restoration control test the following requirements shall apply:
  - a the power park module's technical capability to participate in frequency restoration control shall be demonstrated. The cooperation of both FSM and frequency restoration control shall be checked;
  - b the test shall be deemed successful if the results for both dynamic and static parameters comply with the requirements of point (e) of Article 15(2).



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- 6 With regard to the reactive power capability test the following requirements shall apply:
- a the power park module's technical capability to provide leading and lagging reactive power capability in accordance with points (b) and (c) of Article 21(3) shall be demonstrated;
  - b it shall be carried out at maximum reactive power, both leading and lagging, and shall verify the following parameters:
    - (i) operation in excess of 60 % of maximum capacity for 30 min;
    - (ii) operation within the range of 30-50 % of maximum capacity for 30 min; and
    - (iii) operation within the range of 10-20 % of maximum capacity for 60 min;
  - c the test shall be deemed successful if the following criteria are fulfilled:
    - (i) the power park module operates for a duration no shorter than the requested duration at maximum reactive power, both leading and lagging, in each parameter specified in paragraph 6(b);
    - (ii) the power park module's capability to change to any reactive power target value within the agreed or decided reactive power range is demonstrated; and
    - (iii) no protection action takes place within the operation limits specified by the reactive power capacity diagram.
- 7 With regard to the voltage control mode test the following requirements shall apply:
- a the power park module's capability to operate in voltage control mode referred to in the conditions set out in points (ii) to (iv) of Article 21(3)(d) shall be demonstrated;
  - b The voltage control mode test shall verify the following parameters:
    - (i) the implemented slope and deadband according to Article 21(3)(d)(iii);
    - (ii) the accuracy of the regulation;
    - (iii) the insensitivity of the regulation; and
    - (iv) the time of reactive power activation;
  - c The test shall be deemed successful if the following conditions are fulfilled:
    - (i) the range of regulation and adjustable droop and deadband complies with the agreed or decided characteristic parameters set out in point (d) of Article 21(3);
    - (ii) the insensitivity of voltage control is not higher than 0,01 pu, in accordance with point (d) of Article 21(3); and
    - (iii) following a step change in voltage, 90 % of the change in reactive power output has been achieved within the times and tolerances specified in point (d) of Article 21(3).
- 8 With regard to the reactive power control mode test the following requirements shall apply:
- a the power park module's capability to operate in reactive power control mode, in accordance with point (v) of Article 21(3)(d), shall be demonstrated;
  - b the reactive power control mode test shall be complementary to the reactive power capability test;

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- c the reactive power control mode test shall verify the following parameters:
    - (i) the reactive power setpoint range and increment;
    - (ii) the accuracy of the regulation; and
    - (iii) the time of reactive power activation.
  - d the test shall be deemed successful if the following conditions are fulfilled:
    - (i) the reactive power setpoint range and increment are ensured in accordance with point (d) of Article 21(3); and
    - (ii) the accuracy of the regulation complies with the conditions set out in point (d) of Article 21(3).
- 9 With regard to the power factor control mode test the following requirements shall apply:
- a the power park module's capability to operate in power factor control mode in accordance with point (vi) of Article 21(3)(d) shall be demonstrated;
  - b the power factor control mode test shall verify the following parameters:
    - (i) the power factor setpoint range;
    - (ii) the accuracy of the regulation; and
    - (iii) the response of reactive power due to step change of active power;
  - c the test shall be deemed successful if the following conditions are cumulatively fulfilled:
    - (i) the power factor setpoint range and increment are ensured in accordance with point (d) of Article 21(3);
    - (ii) the time of reactive power activation as a result of step active power change does not exceed the requirement laid down in point (d) of Article 21(3); and
    - (iii) the accuracy of the regulation complies with the value specified in point (d) of Article 21(3).
- 10 With regard to the tests referred to in paragraphs 7, 8 and 9, the relevant system operator may select only one of the three control options for testing.

#### *Article 49*

### **Compliance tests for type D power park modules**

- 1 Type D power park modules are subject to the compliance tests for type B and C power park modules in accordance with the conditions set out in Articles 47 and 48.
- 2 Instead of the relevant test, the power-generating facility owner may use equipment certificates issued by an authorised certifier to demonstrate compliance with the relevant requirement. In that case, the equipment certificates shall be provided to the relevant system operator.

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## CHAPTER 4

### **Compliance testing for offshore power park modules**

#### Article 50

### **Compliance tests for offshore power park modules**

The compliance tests established in Article 44(2), as well as in paragraphs 2, 3, 4, 5, 7, 8 and 9 of Article 48 shall apply to offshore power park modules.

## CHAPTER 5

### **Compliance simulations for synchronous power-generating modules**

#### Article 51

### **Compliance simulations for type B synchronous power-generating modules**

1 Power-generating facility owners shall undertake LFSM-O response simulations in relation to type B synchronous power-generating modules. Instead of the relevant simulations, the power-generating facility owner may use equipment certificates issued by an authorised certifier to demonstrate compliance with the relevant requirement. In that case, the equipment certificates shall be provided to the relevant system operator.

2 With regard to the LFSM-O response simulation the following requirements shall apply:

- a the power-generating module's capability to modulate active power at high frequency in accordance with Article 13(2) shall be demonstrated by simulation;
- b the simulation shall be carried out by means of high frequency steps and ramps reaching minimum regulating level, taking into account the droop settings and the deadband;
- c the simulation shall be deemed successful in the event that:
  - (i) the simulation model of the power-generating module is validated against the compliance test for LFSM-O response described in Article 44(2); and
  - (ii) compliance with the requirement set out in Article 13(2) is demonstrated.

3 With regard to the simulation of fault-ride-through capability of type B synchronous power-generating modules, the following requirements shall apply:

- a the power-generating module's capability to ride through faults in accordance with the conditions set out in subparagraph (a) of Article 14(3) shall be demonstrated by simulation;
- b the simulation shall be deemed successful if compliance with the requirement set out in point (a) of Article 14(3) is demonstrated.

4 With regard to the post fault active power recovery simulation the following requirements shall apply:

- a the power-generating module's capability to provide post fault active power recovery referred to in the conditions set out in Article 17(3) shall be demonstrated;

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- b the simulation shall be deemed successful if compliance with the requirement set out in Article 17(3) is demonstrated.

## Article 52

### Compliance simulations for type C synchronous power-generating modules

1 In addition to the compliance simulations for type B synchronous power-generating modules set out in Article 51, type C synchronous power-generating modules shall be subject to the compliance simulations detailed in paragraphs 2 to 5. Instead of all or part of those simulations, the power-generating facility owner may use equipment certificates issued by an authorised certifier, which must be provided to the relevant system operator.

2 With regard to the LFSM-U response simulation the following requirements shall apply:

- a the power-generating module's capability to modulate active power at low frequencies in accordance with point (c) of Article 15(2) shall be demonstrated;
- b the simulation shall be carried out by means of low frequency steps and ramps reaching maximum capacity, taking into account the droop settings and the deadband;
- c the simulation shall be deemed successful in the event that:
  - (i) the simulation model of the power-generating module is validated against the compliance test for LFSM-U response described in of Article 45(2); and
  - (ii) compliance with the requirement of point (c) of Article 15(2) is demonstrated.

3 With regard to the FSM response simulation the following requirements shall apply:

- a the power-generating module's capability to modulate active power over the full frequency range in accordance with point (d) of Article 15(2) shall be demonstrated;
- b the simulation shall be carried out by simulating frequency steps and ramps big enough to trigger the whole active power frequency response range, taking into account the droop settings and the deadband;
- c the simulation shall be deemed successful in the event that:
  - (i) the simulation model of the power-generating module is validated against the compliance test for FSM response described in Article 45(3); and
  - (ii) compliance with the requirement of point (d) of Article 15(2) is demonstrated.

4 With regard to the island operation simulation the following requirements shall apply:

- a the power-generating module's performance during island operation referred to in the conditions set out in point (b) of Article 15(5) shall be demonstrated;
- b the simulation shall be deemed successful if the power-generating module reduces or increases the active power output from its previous operating point to any new operating point within the P-Q-capability diagram within the limits of point (b) of Article 15(5), without disconnection of the power-generating module from the island due to over- or underfrequency.

5 With regard to the reactive power capability simulation the following requirements shall apply:

- a the power-generating module's capability to provide leading and lagging reactive power capability in accordance with the conditions set out in points (b) and (c) of Article 18(2) shall be demonstrated;

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- b the simulation shall be deemed successful if the following conditions are fulfilled:
  - (i) the simulation model of the power-generating module is validated against the compliance tests for reactive power capability described in Article 45(7); and
  - (ii) compliance with the requirements of points (b) and (c) of Article 18(2) is demonstrated.

### *Article 53*

#### **Compliance simulations for type D synchronous power-generating modules**

1 In addition to the compliance simulations for type B and C synchronous power-generating modules set out in Articles 51 and 52, except for the simulation of fault-ride-through capability of type B synchronous power-generating modules referred to in Article 51(3), type D synchronous power-generating modules are subject to the compliance simulations set out in paragraphs 2 and 3. Instead of all or part of those simulations, the power-generating facility owner may use equipment certificates issued by an authorised certifier, which must be provided to the relevant system operator.

2 With regard to the power oscillations damping control simulation the following requirements shall apply:

- a it shall be demonstrated that the power-generating module's performance in terms of its control system ('PSS function') is capable of damping active power oscillations in accordance with the conditions set out in paragraph 2 of Article 19;
- b the tuning must result in improved damping of corresponding active power response of the AVR in combination with the PSS function, compared to the active power response of the AVR alone;
- c the simulation shall be deemed successful if the following conditions are cumulatively fulfilled:
  - (i) the PSS function damps the existing active power oscillations of the power-generating module within a frequency range specified by the relevant TSO. That frequency range shall include the local mode frequencies of the power-generating module and the expected network oscillations; and
  - (ii) a sudden load reduction of the power-generating module from 1 pu to 0,6 pu of the maximum capacity does not lead to undamped oscillations in active or reactive power of the power-generating module.

3 With regard to the simulation of fault-ride-through capability of type D synchronous power-generating modules, the following requirements shall apply:

- a the power-generating module's capability to provide fault-ride-through in accordance with the conditions set out in point (a) of Article 16(3) shall be demonstrated;
- b the simulation shall be deemed successful if compliance with the requirement laid down in point (a) of Article 16(3) is demonstrated.

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## CHAPTER 6

### **Compliance simulations for power park modules**

#### *Article 54*

#### **Compliance simulations for type B power park modules**

1 Type B power park modules are subject to the compliance simulations in paragraphs 2 to 5. Instead of all or part of those simulations, the power-generating facility owner may use equipment certificates issued by an authorised certifier, which must be provided to the relevant system operator.

2 With regard to the LFSM-O response simulation the following requirements shall apply:

- a the power park module's capability to modulate active power at high frequency in accordance with Article 13(2) shall be demonstrated;
- b the simulation shall be carried out by means of high frequency steps and ramps reaching minimum regulating level, taking into account the droop settings and the deadband;
- c the simulation shall be deemed successful in the event that:
  - (i) the simulation model of the power park module is validated against the compliance test for LFSM-O response set out in Article 47(3); and
  - (ii) compliance with the requirement laid down in Article 13(2) is demonstrated.

3 With regard to the fast fault current injection simulation the following requirements shall apply:

- a the power park module's capability to provide fast fault current injection in accordance with the conditions set out in point (b) of Article 20(2) shall be demonstrated;
- b the simulation shall be deemed successful if compliance with the requirement laid down in point (b) of Article 20(2) is demonstrated.

4 With regard to the fault-ride-through simulation capability of type B power park modules, the following requirements shall apply:

- a the power park module's capability to ride through faults in accordance with the conditions set out in point (a) of Article 14(3) shall be demonstrated by simulation;
- b the simulation shall be deemed successful if compliance with the requirement laid down in point (a) of Article 14(3) is demonstrated.

5 The following requirements with regard to the post fault active power recovery simulation shall apply:

- a the power park module's capability to provide post fault active power recovery in accordance with the conditions set out in Article 20(3) shall be demonstrated;
- b the simulation shall be deemed successful if compliance with the requirement laid down in Article 20(3) is demonstrated.

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## Article 55

### Compliance simulations for type C power park modules

1 In addition to the compliance simulations for type B power park modules set out in Article 54, type C power park modules are subject to the compliance simulations set out in paragraphs 2 to 7. Instead of all or part of those simulations, the power-generating facility owner may use equipment certificates issued by an authorised certifier, which must be provided to the relevant system operator.

2 With regard to the LFSM-U response simulation the following requirements shall apply:

- a the power park module's capability to modulate active power at low frequencies in accordance with point (c) of Article 15(2) shall be demonstrated;
- b the simulation shall be carried out by simulating low frequency steps and ramps reaching maximum capacity, taking into account the droop settings and the deadband;
- c the simulation shall be deemed successful in the event that:
  - (i) the simulation model of the power park module is validated against the compliance test for LFSM-U response set out in Article 48(3); and
  - (ii) compliance with the requirement laid down in point (c) of Article 15(2) is demonstrated.

3 With regard to the FSM response simulation the following requirements shall apply:

- a the power park module's capability to modulate active power over the full frequency range as referred to in point (d) of Article 15(2) shall be demonstrated;
- b the simulation shall be carried out by simulating frequency steps and ramps big enough to trigger the whole active power frequency response range, taking into account the droop settings and the deadband;
- c the simulation shall be deemed successful in the event that:
  - (i) the simulation model of the power park module is validated against the compliance test for FSM response set out in Article 48(4); and
  - (ii) compliance with the requirement laid down in point (d) of Article 15(2) is demonstrated.

4 With regard to the island operation simulation, the following requirements shall apply:

- a the power park module's performance during island operation in accordance with the conditions set out in point (b) of Article 15(5) shall be demonstrated;
- b the simulation shall be deemed successful in the event that the power park module reduces or increases the active power output from its previous operating point to any new operating point, within the P-Q-capability diagram and within the limits set out in point (b) of Article 15(5), without disconnection of the power park module from the island due to over- or underfrequency.

5 With regard to the simulation of the capability of providing synthetic inertia, the following requirements shall apply:

- a the model of the power park module's capability of providing synthetic inertia to a low frequency event as set out in point (a) of Article 21(2) shall be demonstrated;

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- b the simulation shall be deemed successful if the model demonstrates that it complies with the conditions set out in Article 21(2).

6 With regard to the reactive power capability simulation, the following requirements shall apply:

- a the power park module shall demonstrate that it can provide leading and lagging reactive power capability as set out in points (b) and (c) of Article 21(3);
- b the simulation shall be deemed successful if the following conditions are cumulatively fulfilled:
  - (i) the simulation model of the power park module is validated against the compliance tests for reactive power capability set out in paragraph 6 of Article 48; and
  - (ii) compliance with the requirements laid down in points (b) and (c) of Article 21(3) is demonstrated.

7 With regard to the power oscillations damping control simulation, the following requirements shall apply:

- a the model of the power park module shall demonstrate that it can provide active power oscillations damping capability accordance with point (f) of Article 21(3);
- b the simulation shall be deemed successful in the event that the model demonstrates compliance with the conditions described in point (f) of Article 21(3).

#### *Article 56*

#### **Compliance simulations for type D power park modules**

1 In addition to the compliance simulations for type B and C power park modules set out in Articles 54 and 55, except for the fault-ride-through capability of type B power park modules referred to in Article 54(4), type D power park modules are subject to the fault-ride-through capability of power park modules compliance simulation.

2 Instead of all or part of the simulations mentioned in paragraph 1, the power-generating facility owner may use equipment certificates issued by an authorised certifier, which must be provided to the relevant system operator.

3 The model of the power park module shall demonstrate that it is suitable for simulating the fault-ride-through capability in accordance with point (a) of Article 16(3).

4 The simulation shall be deemed successful if the model demonstrates compliance with the conditions set out in point (a) of Article 16(3).



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## CHAPTER 7

### **Compliance simulations for offshore power park modules**

#### *Article 57*

#### **Compliance simulations applicable to offshore power park modules**

The compliance simulations specified in paragraphs 3 and 5 of Article 54 as well as in paragraphs 4, 5 and 7 of Article 55 shall apply to any offshore power park module.

## CHAPTER 8

### **Non-binding guidance and monitoring of implementation**

#### *Article 58*

#### **Non-binding guidance on implementation**

1 No later than six months after the entry into force of this Regulation, the ENTSO for Electricity shall prepare and thereafter every two years provide non-binding written guidance to its members and other system operators concerning the elements of this Regulation requiring national decisions. The ENTSO for Electricity shall publish this guidance on its website.

2 ENTSO for Electricity shall consult stakeholders when providing non-binding guidance.

3 The non-binding guidance shall explain the technical issues, conditions and interdependencies which need to be considered when complying with the requirements of this Regulation at national level.

#### *Article 59*

#### **Monitoring**

1 ENTSO for Electricity shall monitor the implementation of this Regulation in accordance with Article 8(8) of Regulation (EC) No 714/2009. Monitoring shall cover in particular the following matters:

- a identification of any divergences in the national implementation of this Regulation;
- b assessment of whether the choice of values and ranges in the requirements applicable to power-generating modules under this Regulation continues to be valid.

2 The Agency, in cooperation with ENTSO for Electricity, shall produce by 12 months after the entry into force of this Regulation a list of the relevant information to be communicated by ENTSO for Electricity to the Agency in accordance with Article 8(9) and Article 9(1) of Regulation (EC) No 714/2009. The list of relevant information may be subject to updates. ENTSO for Electricity shall maintain a comprehensive, standardised format, digital data archive of the information required by the Agency.

3 Relevant TSOs shall submit to ENTSO for Electricity the information required to perform the tasks referred to in paragraphs 1 and 2.

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Based on a request of the regulatory authority, DSOs shall provide TSOs with information under paragraph 2 unless the information is already obtained by regulatory authorities, the Agency or ENTSO-E in relation to their respective implementation monitoring tasks, with the objective of avoiding duplication of information.

4 Where ENTSO for Electricity or the Agency establish areas subject to this Regulation where, based on market developments or experience gathered in the application of this Regulation, further harmonisation of the requirements under this Regulation is advisable to promote market integration, they shall propose draft amendments to this Regulation pursuant to Article 7(1) of Regulation (EC) No 714/2009.

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