European Network of
Transmission System Operators
for Electricity

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GENERAL GUIDANCE ON COMPLIANCE TESTING AND MONITORING

ENTSO-E guidance document for national implementation for network codes on grid connection

6 March 2017

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DESCRIPTION

Summary

It is a requirement of each of the Connection Network Codes (CNCs) that equipment connected to the system is compliant with the technical requirements forming part of the CNCs at the time that such equipment is first connected and that it then continues to be compliant throughout its life.

Firstly, during the commissioning of any new equipment being connected to the system, appropriate compliance testing, modelling and simulations have to take place as part of the operational notification process and as requested by the relevant system operator (RSO). The RSO shall also 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.

These requirements are in line with the ACER Framework Guidelines on Connection Codes Article 2.4 "the basis of the Compliance testing, compliance monitoring and enforcement" and are likely to be similar in principle to many of the existing national processes through which RSOs seek assurance that equipment connected to their systems is technically appropriate and is capable of meeting standards in terms of technical capability, behaviour or provision of services.

Each of the EU regulations for the CNCs contain requirements relevant to compliance testing, simulation and compliance monitoring:

- Compliance Testing (CT) – verification of the availability of the minimum required functionality and parameter ranges.
- Compliance Simulation (CS) – simulated verification of the availability of the minimum required functionality and parameter ranges especially where testing is not applicable or risk of damaging the facility.
- Compliance Monitoring (CM) - verification the availability of the minimum required functionality and parameter ranges still exist. This activity is an on-going activity throughout the life of the facility.

The aim of the present document is to resume the requirements of the CT, CS and CM and give guidance on CT, CS and CM.

In addition the document resume the operational notification process as CT, CS and CM is addressed to various parts of the notification process.

Definitions

Compliance Testing (CT)
CT is an activity that takes place during the Interim Operational Notification (ION) and the Limited Operational Notification (LON) period with the purpose of demonstrating the compliance with the required specifications.

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Compliance Simulation (CS)
CS is an activity that takes place during the Interim Operational Notification (ION) and the Limited Operational Notification (LON) period with the purpose of demonstrating the compliance with the required specifications.

Compliance Monitoring (CM)
CM is an activity that takes place after the Final Operational Notification (FON) has been issued with the purpose of checking that the compliance of the facility is sustained as long as the FON is in force.

Generator type definitions
The EU regulation 2016/631 defines four types of generators A, B, C and D in Article 5 "Determination of significance".

The fundamental rationale for creating the type definition is that the size of a power generating module impacts the stability of the grid – the larger the more impact.

All requirements in the said regulation are cumulative, with some exemptions, sorted into the four types. The compliance testing and simulation of power generating modules follow the same basic principle.

The following terms, strongly related to compliance testing and monitoring, are introduced in the CNCs. For example, in 2016/631:

Authorised certifier: means an entity that issues equipment certificates and power generating module documents and whose accreditation is given by the national affiliate of the European cooperation for Accreditation ('EA'), established in accordance with Regulation (EC) No 765/2008;

Equipment certificate: means a document issued by an authorised certifier for equipment used by a power generating module, demand unit, distribution system, demand facility or HVDC system. The equipment certificate defines the scope of its validity at a national or other level at which a specific value is selected from the range allowed at a European level. For the purpose of replacing specific parts of the compliance process, the equipment certificate may include models that have been verified against actual test results;

Installation document: means a simple structured document containing information about a type A power generating module or a demand unit, with demand response connected below 1000V, and confirming its compliance with the specified requirements;

Statement of compliance: means a document provided by the power generating facility owner, demand facility owner, distribution system operator or HVDC system owner to the system operator stating the current status of compliance with the relevant specifications and requirements;

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The following terms have been introduced to clarify the certification principles for further application in compliance processes, with the support of the certification industry members and with the purpose of giving and unambiguous link to EN ISO/IEC 17065 as for the underlying accreditation IEC standard

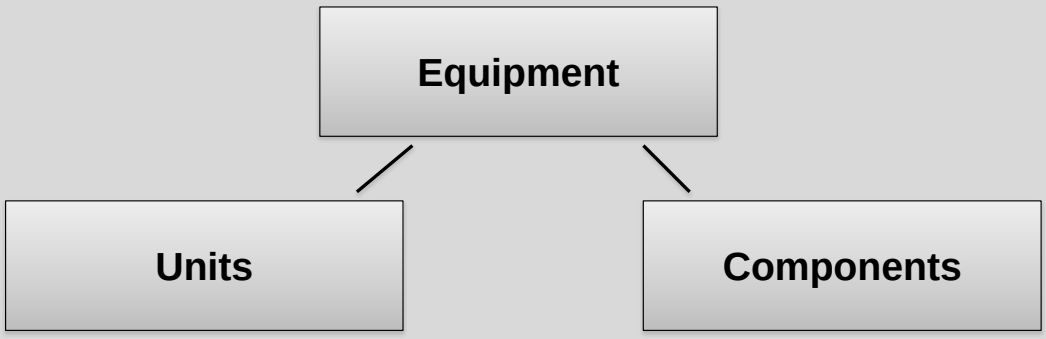

Figure 1: Equipment: units and components

Equipment (used by generator facility, demand facility, HVDC system) that could consist of units and components.

Units
Units which generate or consume electrical energy independently of other units deployed in a power generating or demand facility.

Components
Components, which can be part of an electrical generating unit or
module or facility and that are used for providing controllable active and reactive power.

Based on this distinction, there may be different variants of the Equipment Certificate (EqC) as indicated in figure 2.

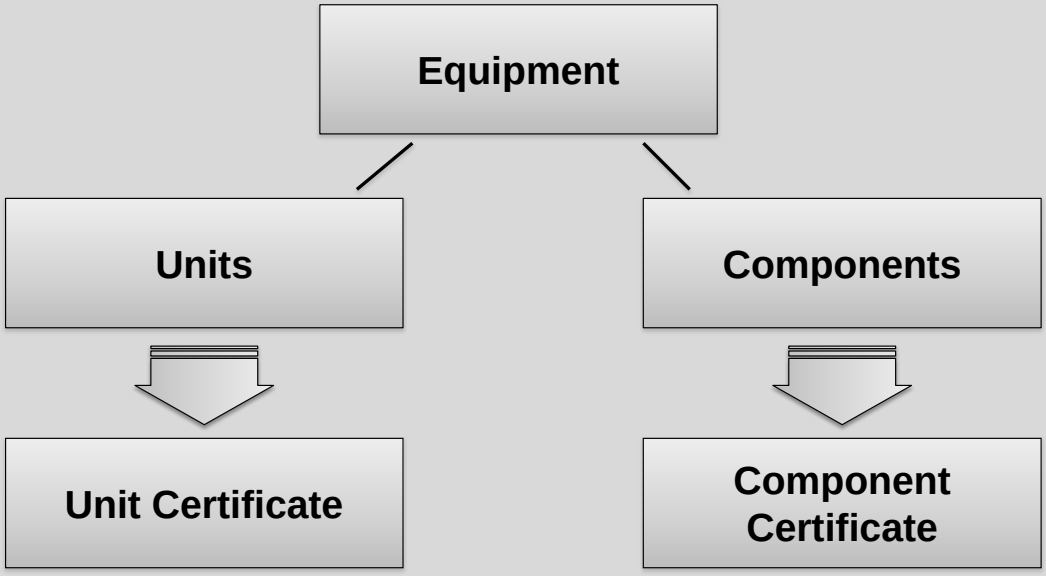

Figure 2: Equipment Certificates (EqCs)

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Unit certificate
A unit certificate is an equipment certificate (EqC) for the specific unit connected to the grid. The unit EqC has the purpose of demonstrating specific parts of the compliance testing process on the unit level, Unit certificate shall include electric simulation models that have been verified.

Component certificate
A component certificate is an equipment certificate for a component of a unit or another component, used in a generating, demand or a HVDC facility. The component EqC has the purpose of demonstrating specific parts of the compliance testing process on the component and the unit level, i.e.

(1) If the component is part of a unit, the component certificate may be applied within a unit certification process, or it can be used on the facility level in connection with the unit certificate(s) to replace specific compliance tests.

(2) If the component is used in another part of the facility, the component certificate can be applied to demonstrate compliance in specific parts of the compliance testing process at facility level.

Note 1: according to the above definition, for Type B and above, a single synchronous power-generating facility, a wind turbine generator system, a wave generating system, a heating plan system etc., could be identified as a unit and, therefore, be subject to a unit certificate.

Compliance testing requirements

Compliance testing requirements specifies to which level the facility owner shall demonstrate compliance to the minimum requirements set out in the CNC in order to be granted a Final Operational Notification (FON).

Each of the CNCs includes requirements that vary on the basis of technical capabilities, scale and the ability of the owner of such facilities to undertake compliance testing or justify the compliance.

Justifications with applying EqCs for a part of the demonstration is accepted as well as demonstrating via application of electrical simulation models for specific facility functions and attributes that could be irreversible to undertake, e.g. a three phase short circuit failure in order to demonstrate the capability of the LVFT functionality.

The responsibility for performing the CT procedures, test specifications and any related effort to fulfil the CT requirements is allocated to the facility owner.

The role of the RSO and TSO is to accept/approve the proposed CT procedures and test specifications and to define CT acceptance criteria in order to demonstrate compliance to the minimum requirements set out in the CNC's.

The CT requirements are specified in the CNCs in the articles following:

EU Regulation 2016/631 (NC RfG)
Title IV Compliance: Chapters 2-7 – Compliance testing & simulations

Chapter 2 – Compliance Testing for Synchronous Power Generating Modules

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Article 44 – Compliance tests for type B synchronous power generating modules
Article 45 – Compliance tests for type C synchronous power generating modules
Article 46 – Compliance tests for type D synchronous power generating modules

Chapter 3 – Compliance Testing for Power Park Modules
Article 47 – Compliance tests for type B power park modules
Article 48 – Compliance tests for type C power park modules
Article 49 – Compliance tests for type D power park modules

Chapter 4 – Compliance Testing for Offshore Power Park Modules
(Note that this is only for AC connected. DC connected offshore PPMs are covered under the 2016/1447)
Selected criteria only drawn from articles 44 and 48.

EU Regulation 2016/1388 (NC DCC)
Title IV Compliance: Chapters 2-3 – Compliance testing & simulations

Chapter 2 – Compliance Testing
Article 36 – Common provisions for compliance testing
Article 37 – Compliance testing for disconnection and reconnection of transmission-connected distribution facilities
Article 38 – Compliance testing for information exchange of transmission-connected distribution facilities
Article 39 – Compliance testing for disconnection and reconnection of transmission-connected demand facilities
Article 40 – Compliance testing for information exchange of transmission-connected demand facilities
Article 41 – Compliance testing for demand response active power control, reactive power control and transmission constraint management

EU Regulation 2016/1447 (NC HVDC)
Title VI Compliance: Chapters 2-3 – Compliance testing & simulations

Chapter 2 – Compliance Testing
Article 69 – Compliance testing for HVDC systems
Article 70 – Compliance testing for DC-connected PPMs and remote end HVDC convertor units

Compliance simulations requirements	Compliance simulation requirements specifies to which level the facility owner can apply electrical imulation models to demonstrate compliance to the minimum requirements set out in the CNC's in order to be granted a Final Operational Notification (FON). Each of the CNCs includes requirements which vary on the basis of technical capabilities, scale and the ability of the owner of such facilities to undertake compliance testing or justify the compliance. Justifications with applying EqCs for a part of the demonstration is accepted as well as demonstrating via application of electrical simulation models for specific facility functions

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	and attributes that could be irreversible to undertake, e.g. a three phase short circuit failure in order to demonstrate the capability of the LVFT functionality. The responsibility for performing the CS procedures, scenario specifications and any related effort to fulfil the CS requirements is allocated to the facility owner. The role of the RSO and TSO is to accept/approve the proposed CS procedures and simulation model and related scenario specifications, and to define CS criteria in order to demonstrate compliance to the minimum requirements set out in the CNC's. The CS requirements are specified in the CNCs in the articles following: **EU Regulation 2016/631 (NC RfG)** ***Title IV Compliance: Chapters 2-7 – Compliance testing & simulations*** *Chapter 5 – Compliance Simulations for Synchronous Power Generating Modules* Article 51 – Compliance simulations for type B synchronous power generating modules Article 52 – Compliance simulations for type C synchronous power generating modules Article 53 – Compliance simulations for type D synchronous power generating modules *Chapter 6 – Compliance Simulations for Power Park Modules* Article 54 – Compliance simulations for type B power park modules Article 55 – Compliance simulations for type C power park modules Article 56 – Compliance simulations for type D power park modules *Chapter 7 – Compliance Simulations for Offshore Power Park Modules* Article 57 – Compliance simulations applicable to offshore power park modules **EU Regulation 2016/1388 (NC DCC)** ***Title IV Compliance: Chapters 2-3 – Compliance testing & simulations*** *Chapter 3 – Compliance Simulation* Article 42 – Common provisions on compliance simulations Article 43 – Compliance simulations for transmission-connected distribution facilities Article 44 – Compliance simulations for transmission-connected demand facilities Article 45 – Compliance simulations for demand units with demand response very fast active power control **EU Regulation 2016/1447 (NC HVDC)** ***Title VI Compliance: Chapters 2-3 – Compliance testing & simulations*** *Chapter 3 – Compliance Simulations* Article 71 – Compliance simulations for HVDC systems Article 72 – Compliance simulations for DC-connected PPMs and remote end HVDC convertor units
Compliance Monitoring Requirements	Compliance monitoring applies when the facility has been granted a FON.

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The intent is to ensure the continued compliance of a facility with the relevant CNC throughout the lifetime of a facility.

The requirements stated in EU regulation 2016/631 (NC RfG) and EU regulation 2016/1447 (NC HVDC) are broadly similar; for EU regulation 2016/1388 (NCN DCC) this is expressed somehow differently as the facilities involved will have more inherent and less active capabilities and the relevant sections are a number of articles dealing with general compliance provisions and a much briefer compliance monitoring chapter.

It is the responsibility of the owner of any facility to which the CNCs are applicable to ensure compliance throughout the lifetime of their equipment. Below it is reported a summary of articles in each code dealing specifically with the requirements for compliance and compliance monitoring:

The responsibility for performing the CM procedures, test specifications and any related effort to fulfil the CM requirements is allocated to the RSO and TSO. Justification of validity of the applied EqCs could be a part of the CM activity or it could be allocated to third party service providers.

The role of the facility owner is to accept the planned CM activities and provide the required information if it requires specific measurements not covered by the information exchange agreed between the facility owner, RSO and TSO..

The CM requirements are specified in the CNCs in the articles following

EU regulation 2016/631 (NC RfG)
Title IV Compliance: Chapter 1 - Compliance Monitoring

Article 40 – Responsibility of the power generating facility owner
It is the responsibility of the power generating facility owner to ensure compliance throughout the lifetime of the facility. Any planned modifications, incidents or failures that could affect compliance are to be informed to the system operator. Any test schedule and procedures to be followed for verifying the compliance should be notified to the system operator who should approve them and may also participate in such tests.

Type A generators may rely on Equipment Certificates (EqCs) rather than the detailed and case specific requirements as set out in title IV.

Article 41 – Tasks of the RSO

RSO shall assess compliance of the generator throughout the lifetime of the facility and will inform the facility owner of the outcome of such tests. v

RSO may rely on EqCs for type A generators.

RSO shall make publicly available the list of information and documents to be provided by the generator and requirements to be fulfilled and the allocation of responsibilities for compliance testing, simulation and monitoring.

The RSO may delegate (totally or partially) the performance of compliance monitoring by third party (e.g. the authorised certifier) can be contracted by RSO.

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The RSO 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

Article 42 – Common provisions for compliance testing
Compliance testing is required to demonstrate that a generator meets the requirements of the regulation. The facility owner is responsible for carrying out the testing in which the system operator may participate either on site or remotely.
The RSO is entitled to:

- allow the facility owner to carry out alternative set of tests, provided that those tests are efficient and suffice to demonstrate that a power generating module (PGM) complies with the requirements of 2016/631;
- require the facility owner to carry out additional or alternative tests in those cases where the information supplied to RSO 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 2016/631;
- require the 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 RSO and facility owner shall agree on which types of fuel are to be tested.

Article 43 – Common provisions on compliance simulation
Simulation by the facility owner is required to demonstrate that the requirements have been met to the specification of the system operator. The facility owner and system operator are both required to provide simulation models; and the system operator is further allowed to run their own simulations to check the compliance of the generator. The RSO is entitled to:

- require the use of validated unit simulation models, validated against test results and CS acceptance criteria
- allow the facility owner to carry out alternative set of simulations, provided that those simulations are efficient and suffice to demonstrate that a PGM complies with the requirements of EU regulation 2016/631 or with national legislation;
- require the facility owner to carry out additional or alternative tests in those cases where the information supplied to RSO 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 2016/631;

EU regulation 2016/1388 (NC DCC)
Title IV Compliance: Chapter 1 - General Provisions, Chapter 4 – Compliance Monitoring

Article 34 - Responsibility of the demand facility owner, the distribution system operator and the closed distribution system operator

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It is the responsibility of any such owner or operator to ensure compliance of their facility. Any planned modifications, incidents or failures that could affect compliance are to be informed to the system operator. Any test schedule and procedures to be followed for verifying the compliance should be notified to the system operator who shall approve them and may also participate in such tests and record the performance.

Where the requirements of EU regulation 2016/1388 (NC DCC) apply to facilities providing DSR services may be delegated by the facility owner to a third party (typically an aggregator) who may also act collectively on behalf of a number of facility owners.

Article 35 – Tasks of the RSO
The RSO shall assess compliance of a facility throughout the lifetime of the facility and will inform the facility owner of the outcome of such tests. The system operator has the right to request the facility owner, DSO or CDSO to perform tests and simulations as required and in particular following any failure, modification or replacement of equipment.

Articles 46-7 - Compliance Monitoring
Specific to 2016/1388 more limited requirements for compliance monitoring are introduced in these articles covering just the requirement to measure reactive power at each connection point and to install the necessary equipment to do this in accordance with 2016/1388 article 15; the time frame for any such monitoring is to be specified by the RSO.

EU regulation 2016/1447 (NC HVDC)
Title VI Compliance: Chapter 1 – Compliance Monitoring

With a minor amount of reordering, the requirements for compliance monitoring are essentially identical in their intent, application and responsibilities to 2016/631. The following articles are included:
Article 67 – Responsibilities of the HVDC system owner and DC-connected PPM owner
Article 68 – Responsibilities of the RSO

Operational Notification Procedure	The first aspect of compliance is the operational notification procedure that all new equipment falling within the scope of the CNCs is required to go through as part of the process of connecting to the system. Each of the CNCs includes similar provisions as summarised below. **2016/631** ***Title III Chapter 1 - Operational Notification Procedure for New Power Generating Modules*** This chapter sets out the requirements for new generators to demonstrate their compliance with title II (articles 13-28), being the detailed technical specifications for generators, as part of their connection process. The operational notification process sets out the steps through which demonstration of these requirements can be achieved including steady state and dynamic performance as required by chapters 2-7 of title IV. The operational notification procedure are specified for each type A-D of power generating module and are broadly as follows.

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Type A generators:
Submission of an installation document as required by the RSO to a minimum standard as detailed in article 30. Any equipment forming part of the installation is to be covered by EqCs issued by an authorised certifier. There is no specific requirement against title IV to demonstrate performance, since Articles 40 and 41 specify that the owner of the power generating facility may rely upon EqCs.

For type A the installation document shall include the EgCs and other additional information such as source (e.g. PV) and kW rating. This is not the case for other types (B, C and D) which need significant site-specific supporting compliance evidence. For instance, a power unit can have a partial covered compliance, but a PPM cannot, because its compliance relies to a large extend on Power Park level control systems. EqCs validate equipment but not necessarily the power generating module, however, EqCs may provide essential information such as type-testing results, proved manufacturer's information and a validated equipment's model and, hence, contribute to the subsequent assessment on Power Park level.

In this case, type A, the RSO may use the EqCs issued by an authorized certifier to assess compliance. It is expected that the EqC may cover all the mandatory requirements for a type A generator.

Type B-D generators – use of equipment certificates (EqCs)
As part of the evidence against which compliance is assessed as detailed below, use of EqCs issued by an authorised certifier is allowed.

Generators can proof evidence of compliance by project certificates for PGMs (e.g. wind or pv plants). Such project certificates can be based on existing type certificates or / and EqCs. Several EqCs may be assessed jointly and extended by missing parts to form full type certificates, providing proof of evidence of compliance for complete generating units as wind turbines, PV inverters etc. Both shall be issued by authorised certifiers.

Type B-C generators:
A Power Generating Module Document (PGMD) is to be provided to the RSO for each power generating module by the power generating facility owner including a statement of compliance; the PGMD is to include information as specified by the RSO within the scope set out in article 32 and shall include where required compliance test reports as required by chapters 2-4 of title IV including use of actual measured values during testing and studies demonstrating steady state and dynamic performance as required by chapters 5-7 of title IV. Tests may to some extend be substituted by the provision of EqCs. Simulations can be based on validated equipment models provided by the EqCs. On acceptance of a complete and satisfactory PGMD the RSO will issue a final operational notification to the facility owner.

Member States can define that the PGMD shall be issued by authorised certifiers, These project certificates should be based on type certificates or/and EqCs.

Type D generators:
For type D generators the process is more involved which takes into account their scale and potential impact on the system, the extent of the services and technical capabilities that they should be able to provide or demonstrate, and their capability to engage in more detailed testing.

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Proof of evidence can be provided e.g. by a project certificate containing simulations with validated electrical simulation models.. These project certificates should be based on type certificates or/and EqCs.

The operational notification procedure for **type D** generators comprises:

Energisation operational notification (EON)
An EON entitles the facility owner to energise their equipment using their connection but not to generate and is subject to the agreement with the RSO of protection and control settings.

Interim operational notification (ION)
An ION entitles the facility owner to operate their power generating module and to generate for a limited period of time – which is to be specified by the RSO but will be no more than 24 months (an extension of this period may be granted if a request for derogation is made to the RSO before the expiry of that period in accordance with the derogation procedure laid down in article 60). Issue of an ION is subject to completion of the data and study review as specified/requested by the RSO including simulation models and studies demonstrating steady state and dynamic performance as required by chapters 5-7 of title IV, and details of the intended compliance tests that are to be undertaken to fulfil chapters 2-4 of title IV. Tests may to some extend be substituted by the provision of EqCs. Simulations can be based on validated equipment models provided by the EqCs.

Final operational notification (FON)
A FON signifies the completion of the operational notification process and allows the power generating facility owner to operate a power generating module using their grid connection.

To progress a FON the facility owner must already hold an ION. Completion of the FON is subject to completion of any outstanding requirements set out in the ION and must include submission, by the facility owner, of an itemized statement of compliance and an update of the technical data, studies and models provided as part of the ION but now also validated and using actual values found through testing.

Part of the FON should be an agreement between RSO and facility owner, how compliance will be monitored over the life time of the generator, taking into account possible changes in generator software, hardware and also changes in the connection point characteristics like short circuit power and frequency impedance characteristics This can be assured by a continuous compliance monitoring as described later on in this document in section "Summary of Common Provisions for Compliance Monitoring
"..

Limited Operational Notification (LON)
A type D generator holding a FON must inform the RSO with whom they hold a connection agreement in the case that their equipment is affected by a temporary loss of capability, is subject to significant modification affecting performance, or is affected by equipment failure affecting performance, in each case where this is expected to last for more than 3 months.

Issue of a LON by the RSO should be subject to identification of the means and timescales by which the non-compliance will be resolved and can last for a maximum of

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12 months without requiring a further derogation. A further expansion of the period of validity of the LON may be granted upon a request for a derogation made by the RSO before the expiry of that period, in accordance with the derogation described in Title V

2016/1388
Title II Connection of Transmission Connected Demand Facilities, Transmission Connected Distribution Facilities and Distribution Systems
Chapter 3 – Operational Notification Procedure
The requirements in 2016/1388 are fairly similar to those in 2016/631. This chapter sets out that each transmission-connected demand facility owner or DSO to which one or more of the requirements in Title II (articles 12-21) apply shall confirm to the RSOs its ability to satisfy these by following an operational notification procedure.

Unlike in EU regulation 2016/631 there are no distinctions in terms of scale or connection voltage to the process which comprises:

Energisation Operational Notification (EON)
This allows energisation of the facility subject to satisfying the RSO of preparations including agreement of protection and control settings.

Interim Operational Notification (ION)
As with 2016/631, an ION entitles the facility owner to operate connected to the system for a limited period of time – which is to be specified by the RSO but will be no more than 24 months (an extension of this period may be granted if a request for derogation is made to the relevant TSO before the expiry of that period in accordance with the derogation procedure laid down in article 50. Issue of an ION is subject to completion of the data and study review as specified and including simulation models as specified in article 21 and studies demonstrating steady state and dynamic performance as required in articles 43 and 46-7. An itemised statement of compliance supported by any EqCs cited in this is also required.

Final operational notification (FON)
A FON signifies the completion of the operational notification process and allows the facility to operate without a time limitation.

To progress a FON the facility owner must already hold an ION. Completion of the FON is subject to completion of any outstanding requirements set out in the ION and must include submission, by the facility owner, of an itemized statement of compliance and an update of the technical data, studies and models provided as part of the ION but now also validated and using actual values found through testing.

2016/1447:
Title V Operational Notification Procedure for Connection
The requirements in HVDC are very similar to those in EU regulation 2016/631 but are subdivided into two sections as follows:
Chapter 1 – Connection of New HVDC Systems
Chapter 2 – Connection of New DC-connected Power Park Modules

Each HVDC system owner is required to demonstrate to the RSO that it has complied with the relevant requirements set out in Titles II-IV articles 11-37 and 46-54 for general HVDC systems, and additionally title III for DC connected PPMs (articles 38-45 but also

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articles 13-22 of 2016/631) at the connection point through the operational notification procedure.

Similarly to 2016/1388 but again unlike in EU regulation 2016/631 there are no distinctions in terms of scale or connection voltage to the process which comprises:

Energisation Operational Notification (EON)
This allows connection and energisation of the facility subject to satisfying the RSO of preparations including agreement of protection and control settings at the connection point.

Interim Operational Notification (ION)
As with 2016/631, an ION entitles the facility owner to operate connected to the system for a limited period of time – which is to be specified by the RSO but will be no more than 24 months (an extension of this period may be granted if a request for derogation is made to the RSO before the expiry of that period in accordance with the derogation procedure laid in Title VII). Issue of an ION is subject to completion of the data and study review as specified and including simulation models as specified in article 54 and studies demonstrating steady state and dynamic performance as required in titles II-IV. An itemised statement of compliance supported by any EqCs cited in this is also required plus details of any intended compliance tests according to article 70 (general HVDC systems) or article 71 (DC-connected PPMs).

Final operational notification (FON)
A FON signifies the completion of the operational notification process and allows the facility to operate without a time limitation.

To progress a FON the facility owner must already hold an ION. Completion of the FON is subject to completion of any outstanding requirements set out in the ION and must include submission, by the facility owner, of an itemised statement of compliance and an update of the technical data, studies and models provided as part of the ION but now also validated and using actual values found through testing.

Limited Operational Notification (LON)
A DC connected PPM holding a FON must inform the RSO with whom they hold a connection agreement in the case that their equipment is affected by a temporary loss of capability, is subject to significant modification affecting performance, or is affected by equipment failure affecting performance, in each case where this is expected to last for more than 3 months.

Issue of a LON by the RSO should be subject to identification of the means and timescales by which the non-compliance will be resolved and can last for a maximum of 12 months without requiring a further derogation.

Derogations
For each of the CNCs , under an ION or a LON where the period for this needs to be extended this will need to be subject to a derogation proposed by the equipment owner and approved by the NRA. The FON process also sets out that any remaining incompatibilities, where these cannot be resolved, can be addressed through the derogation process therefore also being subject to agreement of the NRA.

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Summary of Common Provisions for Compliance Testing

The following table details the requirements against which testing is to be carried out in fulfilment of the requirements of the EU regulation 2016/631 code:

2016/631 Compliance tests:

Unit Type	A	B	C	D
Requirements to be verified				
Title IV-Chapter 2: Synchronous PGM				
LFSM-O	-	X	X	X
LFSM-U	-	-	X	X
FSM	-	-	X	X
Frequency restoration	-	-	X	X
Black start capability	-	-	X	X
Tripping to houseload	-	-	X	X
Reactive power capability	-	-	X	X
Chapter 3: PPMs				
LFSM-O	-	X	X	X
Active power controlability	-	-	X	X
LFSM-U	-	-	X	X
FSM	-	-	X	X
Frequency restoration	-	-	X	X
Reactive power capability	-	-	X	X
Voltage control mode, or	-	-	X	X
reactive power control mode, or	-	-	X	X
power factor control mode	-	-	X	X
Chapter 4: Offshore PPMs				
LFSM-O				
Active power controlability				
LFSM-U				
FSM				
Frequency restoration				
Voltage control mode				
Reactive power control mode				
Power factor control mode				

With regard to the Compliance tests on voltage control mode, reactive power control mode and power factor control mode, the RSO may select only one of the three control options for compliance testing

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Summary of Common Provisions for Compliance Simulation

The following table details the requirements against which simulation is to be carried out in fulfilment of the requirements of the EU regulation 2016/631 code:

2016/631 Compliance Simulations:

Unit Type	A	B	C	D
Requirements to be verified				
Chapter 5: Synchronous PGM				
LFSM-O	-	X	X	X
FRT type B	-	X	X	-
Post fault active power recovery	-	X	X	X
LFSM-U	-	-	X	X
FSM	-	-	X	X
Island operation	-	-	X	X
Reactive power capability	-	-	X	X
Power Oscillation Damping Control (POD)	-	-	-	X
FRT type D	-	-	-	X
Chapter 6: PPMs				
LFSM-O	-	X	X	X
fast fault current injection	-	X	X	X
FRT type B	-	X	X	-
Post fault active power recovery	-	X	X	X
LFSM-U	-	-	X	X
FSM	-	-	X	X
Island operation	-	-	X	X
Synthetic inertia	-	-	X	X
Reactive power capability	-	-	X	X
Power Oscillation Damping Control (POD)	-	-	X	X
FRT type D	-	-	-	X
Chapter 7: Offshore PPMs				
fast fault current injection				
Post fault active power recovery				
Island operation				
Synthetic inertia				
Power Oscillation Damping Control (POD)				

Summary of tests and simulations that have to be carried out:

(S: synchronous generating module)

	TESTING				SIMULATIONS			
Requirements	B	C	D	Offshore	B	C	D	Offshore
LFSM-O	S,PPM	S,PPM	S,PPM	X	S,PPM	S,PPM	S,PPM	
LFSM-U		S,PPM	S,PPM	X		S,PPM	S,PPM	
FSM		S,PPM	S,PPM	X		S,PPM	S,PPM	
Frequency restoration		S,PPM	S,PPM	X				
Black start capability		S	S					
Tripping to houseload		S	S					
Reactive power capability		S,PPM	S,PPM	X		S,PPM	S,PPM	
Active power controlability		PPM	PPM	X				
Voltage control mode		PPM	PPM	X				
Reactive power control mode		PPM	PPM	X				
Power factor control mode		PPM	PPM	X				
Island operation						S,PPM	S,PPM	X
FRT (profiles different B/D)					S,PPM	S,PPM	S,PPM	
Post fault active power recovery					S,PPM	S,PPM	S,PPM	X
Power Oscillation Damping Control (POD)						PPM	S,PPM	X
fast fault current injection					PPM	PPM	PPM	X
Synthetic inertia						PPM	PPM	X

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Compliance basis on unit type level:

As units forming PPM, OPPM and sometimes also PGM and as those are manufactured by volume production (series manufacturing) it makes sense not to repeat prototype testing in each project. Corresponding type certificates can be reused for all PPM projects using the same type of units. Such type certificate can prove compliance with EU regulation 2016/631, 2016/1388 and 2016/1477 including the Member state's specific national requirements certification schemes and test procedures ought to be defined and should - where applicable - refer to existing standards.

Simulation models can be validated against tests on unit type level:

Validation of generating unit electrical simulation models against test results may be performed according to certification procedures that ought to be defined. Generic models for wind turbines can be required by referencing to IEC 61400-27, however, parameterisation should be validated against test results for each unit type and each relevant change in frequency converter software. Support can be provided by authorised certifiers. Simulation models for PPM, Offshore PPM should be based on validated simulation models for the generating units forming part of the PPM.

EU regulation 2016/1388 (NC DCC) compliance tests and simulations:

Compliance Tests	transmission-connected distribution facilities	transmission-connected demand facilities	demand units with DSR
capability of reconnection after an incidental disconnection	x	x	-
synchronisation test	x	x	-
remote disconnection test	x	x	-
low frequency demand disconnection	x	x	-
low frequency demand disconnection relays	x	x	-
low voltage demand disconnection	x	x	-
information exchange	x	x	-
demand modification	-	-	x
disconnection or reconnection of static compensation facilities	-	-	x

Compliance Simulations	transmission-connected distribution facilities	transmission-connected demand facilities	demand units with DSR
reactive power capability without onsite generation	x	x	-
active control of reactive power with onsite generation	x	x	-
very fast active power control	-	-	x

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EU regulation 2016/1447 (NC HVDC) compliance tests and simulations:

Compliance Tests	HVDC systems	DC-connected PPMs	Remote-end HVDC converter units
reactive power capability	x	x	x
voltage control mode	x	x	x
reactive power control mode	x	x	x
power factor control mode	x	x	x
FSM response	x	x	-
LFSM-O response	x	x	-
LFSM-U response	x	x	-
frequency restoration control	-	x	-
active power controllability	x	x	-
ramping rate modification	x	-	-
black start	x	-	-
fast signal response	-	x	-
Compliance Simulations	**HVDC systems**	**DC-connected PPMs**	**Remote-end HVDC converter units**
fast acting additional reactive current injection	x	x	-
fault-ride-through capability	x	x	-
post fault power active power recovery	x	x	-
reactive power capability	x	x	x
Power Oscillation Damping Control (POD)	x	x	-
active power modification in case of disturbance	x	-	-
fast active power reversal	x	-	-

With regard to the Compliance tests on voltage control mode, reactive power control mode and power factor control mode, the relevant TSO may select only two of the three control options for testing

Summary of Common Provisions for Compliance Monitoring

Compliance Monitoring activities could include, but are not limited to activities as follows:

First three years period after final implementation of the CNCs:

- TSO initiated self-survey of, e.g.
  - generator, demand and HVDC facilities
    - frequency parameter settings
  - validity of applied EqCs

Second three years period after final implementation of the CNCs:

- TSO initiated survey of the capability to exchange information

Role of Third Parties: Authorised certifiers and equipment certificates

Whereas regulation (EC) No. 765/2008 defines the general requirements for accreditation and market surveillance relating to the marketing of products with a special focus on the accreditation of conformity assessment bodies, the national accreditation bodies and their respective European co-operation for Accreditation (the EA), it does not give a specific framework for the conformity assessment process itself. This framework is in fact provided by the IEC standard EN ISO/IEC 17065 on the conformity assessment with respect to the requirements for bodies certifying products, processes and services.

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Next to specific regulations for such certification bodies (referring to their structural requirements e.g. on liability, impartiality, confidentiality, their resources/personnels' qualifications and the overall management system) the standard also gives a precise structure on the conformity assessment, which consists of four phases: Application Review – Evaluation – Review – Certification Decision.

The EN ISO/IEC 17065 standard thus contributes to the main purpose of certifying products: to ensure a high degree of confidence to all interested parties that these products fulfil specified standards.

The EN ISO/IEC 17065 standard gives a special emphasis on the precise definition of the product-specific certification process, i.e. the certification scheme, defining its scope, corresponding product standards to be applied, evaluation and assessment methodologies and criteria as well as some formal requirements on issuing, monitoring and terminating certificates.

The evaluation may include any kind of determination and selection of any information that are incorporated in the subsequent conformity assessment (according to the certification scheme) – i.e. measurement results, simulation data, model validation results or manufacturers information. Evaluation activities may be delegated to external resources, that meet the applicable requirements of relevant standards and documents as specified in the certification scheme. I.e., for testing it shall meet the procedural requirements stated in the EN ISO/IEC 17025 which is the corresponding accreditation standard for testing laboratories.

Equipment certification:

The term "equipment" as being part of power-generating modules is not defined in detail in the 2016/631. However, EU regulation 2016/631 provides two alternatives terms, which are feasible to describe these equipment. These are "units" and "components". Both terms are generally also adapted by existing certification schemes.

Remarks:

- Units are basically introduced as entities of power park modules generating electricity (Article 2 (17) 2016/631), thus being either non-synchronously connected to the network or connected through power electronics. However, other passages (i.e. Article 14 (5)(b)(iii), Article 45 (3)(b)) apply the term "unit" also to synchronous generators and power-generating modules in general.
- Components are introduced as "individual components" (like speed and power control, voltage control, etc.) in terms of the model description of power-generating modules in a quite general way (Article 15(6)(c)(ii)).

Power generation module certification:

As the EU regulation 2016/631 enables member states to require the PGMD to be issued by accredited certification bodies, the product certification scheme may as well be applied to the compliance statement of power generation modules. In this case, the evaluation phase basically comprises steady state and dynamic simulation as well as

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simple calculations based on the equipment's' characteristics and validated models as testified in the equipment's' certificates. In addition to this certified equipment information further technical specification and data of the power-generating modules (passive) assets (cables, transformers etc.) together with basic power system network data and models according to article 43 (5), which are required to calculate/simulate the power-generating module's electrical characteristics at the connection point.

Application of EqCs

The application of equipment certificates is defined in two different contexts of compliance testing within the EU regulation 2016/631:

1. As specified in the operational notification procedure for commissioning new installations, Title III, chapter 1, articles 30ff introduce equipment certificates being an optional element.

2. By way of the continued compliance monitoring within the lifetime of existing installations (being subject to the scope of the 2016/631, 2016/1388 and 2016/1447)

a) Title IV, chapter 1, articles 40 and 41 introduce equipment certificates being an optional element of the compliance monitoring process for type A power-generating modules, providing relevant information to the relevant system operator. Moreover, article 41 empowers the relevant system operator to define conditions and procedures to register equipment certificates.

b) Chapter 2 and 3 (articles 44 to 49) provide the option that required tests and measurements in order to demonstrate compliance of synchronous power-generating modules and power park modules (as of type B, C and D) may be substituted by the provision of equipment certificates to the relevant system operator.

c) Chapter 5 and 6 (articles 51 to 56) provide the option that required simulations in order to demonstrate compliance of synchronous power-generating modules and power park modules (as of type B, C and D) may be based on validated unit models provided by equipment certificates to the relevant system operator.

Note 1: for the appropriate deployment of product certificates especially in the (long-term) view of the facilities' lifetime, the monitoring of the certificates' ongoing validity is crucial. However, according to chapter 7.9.4 of DIN EN ISO/IEC 17065 a surveillance scheme has to be established and shall include periodic surveillance activities to ensure ongoing validity of the demonstration of fulfilment of process or service requirements.

Note 2: as by definition, a product certificate provides a statement of the product's conformity to its product standards with a standardised environment (e.g. testing provisions). Therefore, the assessment of the product's behaviour and characteristics within specific project environments (e.g. a specific power-generating module / facility) has always to be evaluated on a site-specific analysis. Hence, the full substitution of required simulations by equipment certificates may be not eligible.

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Deployment of Equipment Certificates

The use of EqCs, and related type and project certificates based on EqCs and issued by an authorised certifier is allowed as part of the fulfilment of the operational notification requirements.

According to the art. 41(3) (g) the RSO is obliged to elaborate and make publicly conditions and procedures for the use of relevant equipment certificates which can be used in the compliance monitoring process. These conditions and procedure have meet the frames requirements given in the NCs, i.e.:

- With regard to the on-site test:
- For type A PGMs the relevant system operator may rely upon equipment certificates issued by an authorized certifier for the assessment (art. 41 (1), also art. 40 (1).
- For type B, and by default to the type C and D synchronous PGMs and PPMs the certificates can be used to demonstrate LFSM-O compliance with the relevant requirements (art. 44(1) and art. 47(1)).
- For type D synchronous PGMs and PPMs instead of the relevant test RSO can use equipment certificates to verify PGM compliance with the relevant requirement (art. 46 (2) and art 49 (2)).

- With regard to the simulations:
- For type B, C, D synchronous PGMs and PPMs instead of the relevant simulations RSO can use equipment certificates to verify PGM compliance with the relevant requirement (art. 51(1), art. 52 (1), art. 53 (1), art. 54 (1), art. 55 (1) and art 56 (2)).
- For type B, C, D synchronous PGMs and PPMs, the software tool used (EMT based or RMS based) should be coordinated in advanced with the RSO in order to allow sharing files containing simulation data
- Concerning the model validation, in order to accept the mismatch between simulations and measurements, it is advisable establishing variable thresholds of tolerance according to the different stages of the phenomena/test instead of a fixed tolerance.
- - In the evaluation of the model both a qualitative approach and a quantitative approach can be used. The qualitative approach is aimed to demonstrate the compliance to the requirements. The quantitative approach is aimed to detailing verify the model (or its component). The tolerances shall be such to permit the use of transfer function commonly in use in the industrial practice.

With regard to the operational notification procedure:

- For type A PGMs compliance process based on the equipment's certificates included in the installation document (art. 30(2) (f)). The relevant system operator may rely upon equipment, type or project certificates issued by an authorised certifier for the assessment. Compliance tests and simulations are not required by the provisions of the EU regulation 2016/631 but possible to execute based on the art. 42 (2) (b) which authorizes RSO to require additional or

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alternatives tests, if information provided by the power-generating owner is not sufficient.

- In general, for type B, C and D PGMs it is allowed to use the equipment, type or project certificates in the notification process. According to the art 32(6) Member States may provide that the Power Generating Module Document (PGMD) designed for Type B and C shall be issued by an authorised certifier.

Summarizing, in principle the equipment, type or project certificates should be used by RSO to verify compliance of the single components of the PGM with the relevant requirements and it should be treated as the additional (complementary) confirmation that the whole PGM meets the requirement. For the power generating facility owner these certificates should be primary guarantee that the used equipment will allow to meet the relevant requirements specified for whole PGM.
In conclusion, for type A units in principle equipment certificates are to be used by the RSO for the assessments in the compliance process. For type B,C,D PGMs equipment, type or project certificates can be used instead of the relevant test or simulations exclusively if It is provided in the rules and procedures elaborated by the TSO, according to the art. 41 (3)(g).

Accreditation of Third Parties

Since CNCs allow it, RSOs shall identify advantages and disadvantages for different compliance monitoring schemes:

- Completely performed by RSOs:
  - high level of expertise needed,
  - compliance procedure developed by the RSO,
  - total control of the process.
- Totally delegated to third parties:
  - lower level of control of the process,
  - need for a very detailed compliance procedure to make sure that different certification entities (to whom RSO delegated) have the same criteria,
  - low work burden for the RSO once the compliance procedure is finished, just receiving and storing certificates
- Partially delegated to third parties

Compliance Testing and Simulation based on certificates issued according to EN ISO/IEC 17065

Product certificates being applied as unit or component certificates according to type C and type D facilities provide a highly-qualified, independent and reliable base for the evidence of compliance with the EU regulations within the 2016/631, 2016/1388 and 2016/1477 context both, on the equipment and on the power-generating module level. Therefore, equipment certificates shall include at least, but are not limited to the following information:

- the technical specification of the equipment entitled by the certificate;
- the results of equipment-specific measurements, including the certifiers' assessment, that the tests have been conducted in compliance to given standards and that results do comply with given certification criteria;

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- a qualified evaluation of respective manufacturers' declaration, where tests are neither technical nor economically feasible;
- an equipment's electrical simulation model, that has been validated against measurement results with respect to given validation criteria (procedure, thresholds, tolerances); including the certifiers assessment, that the validation have been conducted in compliance to given standards

Based on this product certificates, the specific parts of the compliance process, that can be replaced by a valid certificate are:

(1) fault-ride-through/Dynamic Tests
(2) frequency control tests

In the same manner power-generating module certificates (PGMD issued by certifiers) provide all benefits of the well-structured, standardized and high-level conformity assessment processes of accredited certification bodies which are supervised by the national accreditation authorities according to regulation (EC) No. 765/2008.

As product certificates, by their nature, do not replace routine tests of the respective products it is highly recommended to amend the power-generating module certification by site specific inspections confirming the correct values of control and protection settings.

INTERDEPENDENCIES	
Within CNCs	This IGD covers the CM and CT activities required in three Connection Network CNCs –2016/631; 2016/1388; 2016/1447
In other NCs	Yes, non-mandatory services (such as black start which is detailed in the NC Emergency & Restoration) offered to the TSO will be subject to compliance monitoring.
System characteristics	All Compliance Monitoring activities shall be addressed to the connection point for the facility.
Technology characteristics	N/A

COORDINATION	
TSO – MS-NRA	In the event that compliance is not established the right to connect to the system or to import/export power through the connection point can be withheld or removed from the facility owner by the RSO; alternatively, a derogation could be sought from the NRA.
TSO – facility owner – DSO-CDSO	Compliance Monitoring is required as part of the connection procedure and has to be maintained during the lifetime of the facility. Compliance Monitoring is the responsibility of the relevant TSO and the RSO.

ANNEX

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Current practices across Europe

Example test, assessment and certification procedures from non-governmental sources are currently showing best practices, e.g. in Spain (last column) the document PVVC is providing tests in chapter 6.2.2 and evaluation of results (assessment) in chapter 4.1, both regarding FRT (Fault Ride Through) as indicated on the left side of the line (first column).

Applicable in:	France				Germany				International		Italy			Spain	
Voltage level:	HV			MV	HV & MV				all		LV	MV	HV	HV	
below document contains the following subject:	declaration or EqC	simulation	test		Equipment Test	Equipment Certificate (EqC)	Facility Certificate	Facility Inspection	Definitions in Annex A	Equipment test and assessment	test	test	test	test	assessment
Documents (page 25):	DTR			RES 64E	TG 3	TG 8			ST-0125		0-21	0-16	TRN	PVVC	
numbers X in table referring to: Examples from RfG	Chapter 8.3, Annex 28.3, Fiche X within DTR			Fiche X in 4.1 of RES 64E	Chapter X	Chapter X	Chapter X	Annex X	Def. XX, table 1-1	Section X	Annex X	Annex X	Annex X	Chapter X	Chapter X
LFSM-O	1, 20		20	4	4.1.3	3.1.2.3	3.3.5		D5	2.4.2	B.1.3.1	N.7.2	A.18		
LFSM-U						3.1.2.4			D6	2.4.2	-	-	A.18		
FSM	1		14, 16	4		3.1.2.4			1-1	2.4.2	B.1.3.1	N.7.2	A.18		
Frequency restoration			15, 16		4.1.4	3.1.4.2			D3	2.4.1					
Black start capability									1-1				A.19		
House load			21			3.1.8			D2	2.4.1					
VAR capability	1	5	17	3	4.2.2	3.1.5.1	3.3.7		R5	2.4.4	B.1.2.1	N.6	A.18		
kW control				4	4.1.2	3.1.2.2	3.3.5	A	D3	2.4.1	B.1.3.1	N.7	A.18		
Voltage control mode	1		17, 18, 19		4.2.5	3.1.5.1	3.3.7	A	D11	2.4.1		N.6	A.18		
VAR control				3	4.2.4	3.1.5.1	3.3.7	A	D8	2.4.5	B.1.2.3	N.6	A.18		
Power factor control mode				3	4.2.4 4.2.6	3.1.5.1	3.3.7	A	D9	2.4.5	B.1.2.3	N.6	A.18		
Island oper.									D2	2.6					
FRT	9			6	4.6	3.1.7	3.3.4.1		D12	3.3	B.1.5	N.8	-	6.2.2	4.1
Post fault active power recovery					4.6	3.1.7.9	3.3.4.1		1-1	3.3.4.8					
POD control									D12I	2.4.1					
Fast current injection					4.6	3.1.7.9	3.3.4.1		D14	2.5					
Synthetic inertia					4.1.3	3.1.2.3	3.3.5		D7	2.4.3					

Status of the documents used is January 2017 or before, please use updated versions if applicable. The links to the documents used within the table are the following:

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DTR	RTE DTR (documentation technique de référence):	http://clients.rte-france.com/htm/fr/mediatheque/telecharge/reftech/20-10-14_article_8-3__v3.pdf
RES 64	ERDF-PRO-RES 64E	http://www.enedis.fr/sites/default/files/Enedis-PRO-RES_64E.pdf
TG3	FGW Technical Guideline Part 3	http://www.wind-fgw.de/pdf/TG_Part3_Rev24_EN_preview.pdf
TG8	FGW Technical Guideline Part 8	http://www.wind-fgw.de/pdf/TG_Part8_Rev7_EN_preview.pdf
ST-0125	DNVGL-ST-0125 Standard, Grid Code Compliance	https://rules.dnvgl.com/docs/pdf/DNVGL/ST/2016-03/DNVGL-ST-0125.pdf
0-21	CEI-0-21	http://ceiweb.it/it/comunicati/news/568-norma-cei-0-21.html
0-16	CEI-0-16	http://www.ceinorme.it/it/comunicati/news/569-norma-cei-0-16.html
TRNA	Terna Grid Code	https://www.terna.it/it-it/sistemaelettrico/codicedirete.aspx
PVVC	AEE PVVC "Procedure for Verification, Validation and Certification"	http://www.aeeolica.org/en/contact/

Other References	The following documents have been considered relevant by the Expert Group on Compliance Monitoring: • Source 1: National Grid (GB TSO) Annexes to National Grid's internal Transmission Procedure TP130 – New Connections Operational Approval: • Compliance statement • Operational notification compliance checklist (ONCC) The ONCC is required to be completed as part of the Operational Notification process. The compliance statement is filled in as part of the testing, by National Grid, of a transmission connected generator. • Guidance Notes – Power Park Modules • Compliance process Source 2: Specific procedures from companies participating in the Expert Group on Compliance Monitoring. The list of private companies that provide services of checking conformity and compliance against standards can be consulted by each RSO to their national accreditation bodies in the website of EA (The European cooperation for Accreditation): http://www.european-accreditation.org/ea-members The European cooperation for Accreditation or EA is an association of national accreditation bodies in Europe that are officially recognised by their national Governments to assess and verify—against international standards—organisations that carry out evaluation services such as certification, verification, inspection, testing and calibration (also known as conformity assessment services). Consumers, businesses, regulators and other organisations all over the world want to be able to trust and have confidence in the goods and services they buy and use. As a consequence, there has been a growth in specified national and international standards for products, processes and services. When applied correctly, these can make life safer, healthier and easier for everyone and can enable communication and trade, while allowing resources to be used more efficiently. Organisations that check conformity and compliance against standards must have the technical competence and integrity to carry out these assessment services. I Source 3: ENA: Energy Networks Association documents • ENA Type Test Verification Report Register (http://www.energynetworks.org/electricity/engineering/distributed-generation/ena-type-test-verification-report-register.html) The ENA Type Test Verification Report Register enables all visitors to access the Type Test Verification reports as required by Engineering Recommendations G83 & G59 for products related to small scale electricity generation in the UK market including PV panels, wind turbines, CHP Units etc up to 50kW.

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	The Energy Networks Association (ENA) has developed and hosts the site in order to promote product identification and information sharing but it is the responsibility of the product manufacturers to upload and maintain data and documentation relating to their products. • DG Connection Guides (x4) (http://www.energynetworks.org/electricity/engineering/distributed-generation/dg-connection-guides.html) There are four separate Distributed Generation Connection Guides, each with a corresponding 'Summary' guide. The purpose of the summary guides is to act as a quick check, providing only the most useful information in a condensed format. Each full guide has a flowchart that guides you to the most relevant Connection Guide for the Distributed Generation you are planning to install. The Guides are intended to help you, as an owner or developer of Distributed Generation, to connect your generating plant to one of the UK's electricity distribution networks • ERG59 from "Engineering recommendation G59: Recommendations for the connection of generating plant to the distribution systems of licensed distribution network operators" – one complete connection document up to 50MW and includes all type testing requirements for the various technologies.

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