EUROPEAN NETWORK CODE:
REQUIREMENT FOR GENERATORS
Mapping to GB Codes

Version of RFG:	Informal Draft 14/01/2014
Date Mapping prepared:	Article 1-23: 12 March 2014 (CMWG)
	Article 24-end: 27 March 2014 (pending)
ECCAF Meeting:	TBC
Send to Code Panels:	TBC

All queries to ECCAF Technical Secretary europeancodes.electricity@nationalgrid.com in the first instance.

General and overall issues for Code Mapping

- Outstanding query of how D-Code/G-Code are structured going forwards (to be considered by GCRP/DCRP Workgroup)
- Need to be clear where requirements for Types of generators are located, i.e. a Type D at 132kV will be Distribution connected in England and Wales and Transmission Connected in Scotland
- Need to ensure that if requirements are in two different GB Codes they are consistent / equivalent.
- How do we interpret "relevant Network Operator" – this may mean that Type D requirements are different depending on if they are in E+W or Scot at 132kV.
- May be consequential changes to the CUSC if scopes of items currently covered in bilateral connection agreements are changed.
- The Electricity Safety, Quality and Continuity Regulations (ESQCR) uses 132kV as a threshold voltage, whereas RFG used 110kV.
- Any references to "Article 4(3)" need to refer to a process in the relevant Code and refer to the GB Governance process, with the obligation place on the relevant TSO or DNO as per the text.

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
Title 1									
GENERAL PROVISIONS									
Article 1									
Subject matter									
This Regulation establishes a network code which defines a common framework of grid connection requirements for Power Generating Facilities, including Synchronous Power Generating Modules, Power Park Modules and Offshore Generation Facilities. It also defines a common framework of obligations for Network Operators to appropriately make use of the Power Generating Facilities' capabilities in a transparent and non-discriminatory manner ensuring a level-playing field throughout the European Union.						Does not require transposition			
Article 2									
DEFINITIONS									
For the purposes of this Regulation, the definitions in Article 2 of Regulation (EC) No 714/2009, Article 2 of Commission Regulation No [000/2014 – CACM], as well as of Article 2 of Regulation 543/2013 on submission and publication of data in electricity markets[1] and Art. 2 of Directive 2009/72/EC shall apply. In addition, the following definitions shall apply: **[THE CONSISTENCY OF DEFINITIONS ACROSS NETWORK CODES IS CURRENTLY EBING REVIEWED BY ENSTSO-E AND ACER]**							Individual definitions to be managed through the GB change process.	Global issue on treatment of definitions; GB vs EU, and handling multiple EU definitions.	
1) **Active Power** - is the real component of the Apparent Power at fundamental Frequency, expressed in watts or multiples thereof (e.g. kilowatts (kW) or megawatts (MW)).									
2) **Active Power Frequency Response** - is an automatic response of Active Power output from a Power Generating Module, in response to a change in system Frequency from the nominal system Frequency.									
3) **Agency** is The Agency for the Cooperation of Energy Regulators (ACER) as established by Regulation (EC) No 713/2009									
4) **Alternator –** is a device that converts mechanical energy into electrical energy by means of a rotating magnetic field.									
5) **Apparent Power** - is the product of Voltage and Current at fundamental Frequency, and the square root of three. It is usually expressed in kilovolt-amperes (kVA) or megavolt-amperes (MVA) and consists of a real component (Active Power) and an imaginary component (Reactive Power).									
6) **Authorised Certifier** - is an entity to issue Equipment Certificates. The accreditation of the Authorised Certifier shall be given from the national affiliation of the European co-operation for Accreditation (EA), established according to Regulation (EC) 765/2008.									

[1] ABl …

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7) **Automatic Voltage Regulator (AVR)** - is the continuously acting automatic equipment controlling the terminal Voltage of a Synchronous Power Generating Module by comparing the actual terminal Voltage with a reference value and controlling by appropriate means the output of an Excitation Control System, depending on the deviations.									
8) **Black Start Capability** - is the capability of recovery of a Power Generating Module from a total shutdown through a dedicated auxiliary power source without any electrical energy supply which is external to the Power Generating Facility.									
9) **Closed Distribution System Operator (CDSO)** - is a natural or legal person operating, ensuring the maintenance of and, if necessary, developing a closed distribution Network according to Article 28 of Directive 2009/72/CE.									
10) **Compliance Monitoring** - is the process to verify that the (technical) capabilities of Power Generating Modules are maintained compliant by the Power Generating Facility Owner with the specifications and requirements of this Network Code.									
11) **Compliance Simulation** - is the process to verify that Power Generating Modules are compliant with the specifications and requirements of this Network Code, for example before starting their operation. The verification should include, inter alia, the revision of documentation, the verification of the requested capabilities of the Power Generating Module by simulation studies and the revision against actual measurements.									
12) **Compliance Testing** - is the process to verify that Power Generating Modules are compliant with the specifications and requirements of this Network Code, for example before starting their operation. The verification includes, inter alia, the revision of documentation, the verification of the requested capabilities of the Power Generating Module by practical tests.									
13) **Connection Agreement** - is a contract between the Relevant Network Operator and the Power Generating Facility Owner which includes the relevant site and technical specific requirements for the Power Generating Facility.									
14) **Connection Point** - is the interface at which the Power Generating Module is connected to a transmission, distribution or closed distribution Network according to Article 28 of Directive 2009/72/CE as identified in the Connection Agreement.									
15) **Control Area** - is a part of the interconnected electricity transmission system controlled by a single TSO.									
16) **Cost-Benefit Analysis** – is a process by which the expected costs of alternative actions aiming at the same objective are compared to the expected benefits in order to determine the alternative with the highest net socio-economic benefit. If applicable, the alternatives include network-based and market-based actions.									
17) **Current** - unless stated otherwise, Current refers to the root-mean-square value of the phase Current.									
18) **Derogation** - is a time limited or indefinite (as specified) acceptance in writing of a non-compliance of a Power Generating Module with regard to identified requirements of this Network Code.									

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19) **Droop** - is the ratio of the steady-state change of Frequency (referred to nominal Frequency) to the steady-state change in power output (referred to Maximum Capacity) expressed in percentage terms.									
20) **Distribution System Operator (DSO)** - is a natural or legal person responsible for operating, ensuring the maintenance of and, if necessary, developing the distribution Network in a given area and, where applicable, its interconnections with other Networks and for ensuring the long-term ability of the Network to meet reasonable demands for the distribution of electricity.									
21) **Energisation Operational Notification (EON)** - is a notification issued by the Relevant Network Operator to a Power Generating Facility Owner prior to energisation of its internal Network. An EON entitles the Power Generating Facility Owner to energise its internal Network by using the grid connection.									
Equipment Certificate - is a document issued by an Authorised Certifier for equipment used in Power Generating Modules confirming performance in respect of the requirements of this Network Code. In relation to those parameters, for which this Network Code defines ranges rather than definite values, the Equipment Certificate shall define the extent of its validity. This will identify its validity at a national or other level at which a specific value is selected from the range allowed at a European level. The Equipment Certificate can additionally include models confirmed against test results for the purpose of replacing specific parts of the compliance process for Type B, C and D Power Generating Modules. The Equipment Certificate will have a unique number allowing simple reference to it in the Installation Document or the Power Generating Module Document. An Equipment Certificate is intended to collate verified data and performance for a specific make and type of Power Generating Module. The purpose of this process is to repeatedly use this data, where relevant, to verify specific parts of data and performance in place of part of the Operational Notification Procedure.									
22) **Excitation Control [**									
23) **System** - a feedback control system that includes the synchronous machine operating in the power system and its excitation system.									
24) **Existing Power Generating Module** - is a Power Generating Module which is not a New Power Generating Module or which is a new Power Generating Module whose classification as an emerging technology according to Article 60 of this Network Code has been revoked according to Article 61 of this Network Code.									
25) **Final Operational Notification (FON)** - is a notification issued by the Relevant Network Operator to a Power Generating Facility Owner confirming that the Power Generating Facility Owner is entitled to operate the Power Generating Module by using the grid connection because compliance with the technical design and operational criteria has been demonstrated as referred to in this Network Code.									

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26) **Frequency -** is the Frequency of the electrical power system that can be measured in all Network areas of the synchronous system under the assumption of a coherent value for the system in the time frame of seconds (with minor differences between different measurement locations only); its nominal value is 50 Hz.									
27) **Frequency Control** - is the capability of a Power Generating Module to control speed by adjusting the Active Power Output in order to maintain stable system Frequency (also acceptable as speed control for Synchronous Power Generating Modules).									
28) **Frequency Response Deadband** - is used intentionally to make the Frequency Control not responsive. In contrast to (in)sensitivity, deadband has an artificial nature and basically is adjustable.									
29) **Frequency Response Insensitivity** - is the inherent feature of the control system defined as the minimum magnitude of the Frequency (input signal) which results in a change of output power (output signal).									
30) **Frequency Sensitive Mode (FSM)** - is a Power Generating Module operating mode which will result in Active Power output changing, in response to a change in System Frequency, in a direction which assists in the recovery to Target Frequency, by operating so as to provide Frequency Response.									
31) **Houseload Operation** - in case of Network failures resulting in disconnection of Power Generating Modules from the Network and being tripped onto their auxiliary supplies, house-load operation ensures that Power Generating Facilities are able to continue to supply their in-house loads.									
32) **Inertia** - is the fact that a rotating rigid body such as an Alternator maintains its state of uniform rotational motion. Its angular momentum is unchanged, unless an external torque is applied. In the context of this code, this definition refers to the technologies for which Alternator speed and system Frequency are coupled.									
33) **Installation Document** - is a simple structured document (data/tick sheet) containing information about a Type A Power Generating Module and confirming compliance with the relevant requirements of this Network Code. The blank Installation Document shall be available from the Relevant Network Operator for the Type A Power Generating Facility Owner or alternatively the site installer on the owner's behalf to fill in and submit to the Relevant Network Operator.									
34) **Instruction** - is a command given orally, manually or by automatic remote control facilities, e. g. a Setpoint, from a Network Operator to a Power Generating Facility Owner in order to perform an action.									
35) **Interim Operational Notification (ION)** - is a notification issued by the Relevant Network Operator to a Power Generating Facility Owner confirming that the Power Generating Facility Owner is entitled to operate the Power Generating Module by using the grid connection for a limited period of time and to undertake compliance tests to meet the technical design and operational criteria of this Network Code.									

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36) **Island Operation** - is the independent operation of a whole or a part of the Network that is isolated after its disconnection from the interconnected system, having at least one Power Generating Module supplying power to this Network and controlling the Frequency and Voltage.									
37) **Limited Frequency Sensitive Mode – Overfrequency (LFSM-O)** - is a Power Generating Module operating mode which will result in Active Power output reduction in response to a change in System Frequency above a certain value.									
38) **Limited Frequency Sensitive Mode – Underfrequency (LFSM-U)** - is a Power Generating Module operating mode which will result in Active Power output increase in response to a change in System Frequency below a certain value.									
39) **Limited Operational Notification (LON)** - is a notification issued by the Relevant Network Operator to a Power Generating Facility Owner which has previously reached FON status, but is temporarily subject to either a significant modification or loss of capability which has resulted in non-compliance to the Network Code.									
40) **Maximum Capacity** - is the maximum continuous Active Power which a Power Generating Module can feed into the Network as defined in the Connection Agreement or as agreed between the Relevant Network Operator and the Power Generating Facility Owner. It is also referred to in this Network Code as P_{max}.									
41) **Minimum Regulating Level** - is the minimum Active Power as defined in the Connection Agreement or as agreed between the Relevant Network Operator and the Power Generating Facility Owner, that the Power Generating Module can regulate down to and can provide Active Power control.									
42) **Minimum Stable Operating Level** - is the minimum Active Power as defined in the Connection Agreement or as agreed between the Relevant Network Operator and the Power Generating Facility Owner, at which the Power Generating Module can be operated stably for unlimited time.									
43) **Network** - is plant and apparatus connected together in order to transmit or distribute electrical power.									
44) **Network Operator** - is an entity that operates a Network. These can be either a TSO, a DSO or CDSO.									
45) **New Power Generating Module** - is a Power Generating Module for which									
- with regard to the provisions of the initial version of this Network code, a final and binding contract of purchase of the main plant has been signed after the day, which is two years after the day of the entry into force of this Network Code, or,									
- with regard to the provisions of the initial version of this Network code, no confirmation is provided by the Power Generating Facility Owner, with a delay not exceeding thirty months as from the day of entry into force of this Network Code, that a final and binding contract of purchase of the main plant exists prior to the day, which is two years after the day of the entry into force of this Network Code, or,									

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- with regard to the provisions of any subsequent amendment to this Network Code and/or after any change of thresholds pursuant to the re-assessment procedure of Article 3(6), a final and binding contract of purchase of the main plant has been signed after the day, which is two years after the entry into force of any subsequent amendment to this Network Code and/or after the entry into force of any change of thresholds pursuant to the re-assessment procedure of Article 3(6).									
46) **Offshore Connection Point** - is a Connection Point located offshore.									
47) **Offshore Grid Connection System** - is the complete interconnection between the Offshore Connection Point and the connection to the interconnected onshore system at the Onshore Grid Interconnection Point.									
48) **Offshore Power Park Module** - is a Power Park Module located offshore with an Offshore Connection Point.									
49) **Onshore Grid Interconnection Point** - is the point at which the Offshore Grid Connection System is connected to the onshore Network of the Relevant Network Operator.									
50) **Overexcitation Limiter** - is a control device within the AVR which prevents the rotor of an Alternator from overload by limiting the excitation Current.									
51) **Power Factor** - is the ratio of Active Power to Apparent Power.									
52) **Power Generating Facility** - is a facility to convert primary energy to electrical energy which consists of one or more Power Generating Modules connected to a Network at one or more Connection Points.									
53) **Power Generating Facility Owner** - is a natural or legal entity owning a Power Generating Facility.									
54) **Power Generating Module** - is either a Synchronous Power Generating Module, or a Power Park Module.									
55) **Power Generating Module Document (PGMD)** - is a document issued by the Power Generating Facility Owner to the Relevant Network Operator for a Type B or C Power Generating Module. The PGMD is intended to contain information confirming that the Power Generating Module has demonstrated compliance with the technical criteria as referred to in this Network Code and provided the necessary data and statements including a Statement of Compliance.									
56) **Power Park Module (PPM)** - is a unit or ensemble of units generating electricity, which is either connected to the Network non-synchronously or through power electronics, and also has a single Connection Point to a transmission, distribution or closed distribution Network									
57) **Power System Stabilizer (PSS)** - is an additional functionality of the AVR of a Synchronous Power Generating Module with the purpose of damping power oscillations									
58) **Pump-Storage** - is a hydro unit in which water can be raised by means of pumps and stored to be used later for the generation of electrical energy.									
59) **P-Q-Capability Diagram** - describes the Reactive Power capability of a Power Generating Module in context of varying Active Power at the Connection Point.									
60) **Reactive Power** - is the imaginary component of the Apparent Power at fundamental Frequency, usually expressed in kilovar (kvar) or megavar (Mvar).									

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61) **Relevant National Regulatory Authority** - is the regulatory authority as referred to in Article 35(1) of Directive 2009/72/EC.									
62) **Relevant CDSO** - is the CDSO to whose Network a Power Generating Module is or will be connected.									
63) **Relevant DSO** - is the DSO to whose Network a Power Generating Module is or will be connected.									
64) **Relevant Network Operator** - is the operator of the Network to which a Power Generating Module is or will be connected.									
65) **Relevant TSO** - is the TSO in whose Control Area a Power Generating Module is or will be connected to the Network at any Voltage level.									
66) **Secured Fault** - is defined as a fault, which is successfully cleared by Network protection according to the Network Operator's planning criteria.									
67) **Setpoint** - is a target value for any parameter typically used in control schemes.									
68) **Significant Power Generating Module** - is a Power Generating Module which is deemed significant on the basis of its impact on the cross-border system performance via influence on the control area's security of supply, which is identified according to the criteria set forth in this Network Code and falls within one of the categories provided in Article 3(6).									
69) **Slope** - is the ratio of the change in Voltage, based on nominal Voltage, to a change in Reactive Power infeed from zero to maximum Reactive Power, based on maximum Reactive Power.									
70) **Statement of Compliance** - is a document provided by the Power Generating Facility Owner to the Network Operator stating the current status with respect to compliance itemised for each relevant element of this Network Code.									
71) **Steady-State Stability** - if the Network or a Synchronous Power Generating Module previously in the steady-state reverts to this state again following a sufficiently minor disturbance, it has Steady-State Stability.									
72) **Synchronous Compensation Operation** - is the operation of an Alternator without prime mover to regulate Voltage dynamically by production or absorption of Reactive Power									
73) **Synchronous Area** - means an area covered by interconnected TSOs with a common System Frequency in a steady state such as the Synchronous Areas Continental Europe (CE), Cyprus (CY), Great Britain (GB), Ireland (IRE), Northern Europe (NE) and the power systems of Lithuania, Latvia and Estonia (Baltic) as a part of a Synchronous Area.									
74) **Synchronous Power Generating Module** - is an indivisible set of installations which can generate electrical energy. It is either a									
- a single synchronous unit generating power within a Power Generating Facility directly connected to a transmission, distribution or closed distribution Network, or									
- an ensemble of synchronous units generating power within a Power Generating Facility directly connected to a transmission, distribution or closed distribution Network with a common Connection Point, or									

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- an ensemble of synchronous units generating power within a Power Generating Facility directly connected to a transmission, distribution or closed distribution Network that cannot be operated independently from each other (e. g. units generating in a combined-cycle gas turbine facility), or									
- a single synchronous storage device operating in electricity generation mode directly connected to a transmission, distribution or closed distribution Network, or									
- an ensemble of synchronous storage devices operating in electricity generation mode directly connected to a transmission, distribution or closed distribution Network with a common Connection Point.									
75) **Synthetic Inertia** - is a facility provided by a Power Park Module to replicate the effect of Inertia of a Synchronous Power Generating Module to a prescribed level of performance.									
76) **Transmission System Operator (TSO)** - is a natural or legal person responsible for operating, ensuring the maintenance of and, if necessary, developing the transmission system in a given area and, where applicable, its interconnections with other systems, and for ensuring the long-term ability of the system to meet reasonable demands for the transmission of electricity.									
77) **U-Q/P_{max}-profile** - is a profile representing the Reactive Power capability of a Power Generating Module in context of varying Voltage at the Connection Point.									
78) **Underexcitation Limiter** - is a control device within the AVR, the purpose of which is to prevent the Alternator from losing synchronism due to lack of excitation.									
79) **Voltage** - unless stated otherwise, Voltage refers to the root-mean-square value of the phase-to-phase Voltage.									
80) **1 pu grid Voltage** - for the 400 kV grid Voltage level (or alternatively commonly referred to as 380 kV level) the reference 1 pu value is 400 kV, for other grid Voltage levels the reference 1 pu Voltage may differ for each TSO in the same synchronous area i.e. the Voltage range in kV for all TSOs within a synchronous area may not be the same.									
Article 3									
Scope									
1. This Commission Regulation sets out common rules for the connection of power generation modules to the interconnected system in the internal market in electricity						Does not require transposition			
2. Member States and national regulatory authorities shall ensure that the terms and conditions upon which Power Generating Modules are granted connection to the interconnected system meet the requirements of this Commission Regulation.									Legislation required for NRA to have necessary powers
3. National Regulatory Authorities shall have the right to require that national agreements between network operators and generators (e.g. in national Network Codes), relating to grid connection requirements for Power Generating Facilities reflect the requirements set forth in this Commission Regulation.									Legislation required for NRA to have necessary powers Licence changes to oblige others

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Article 3a										
Application to New and Existing generators										
1.	The requirements set forth by this Network Code shall apply to New Power Generating Modules in a Member State which are considered to significant according to the provisions of this Network Code unless otherwise provided in this Network Code.						Scope statement in all documents where the requirements are placed e.g. G-Code, D-Code, Engineering Recommendations			May require secondary legislation, for 'enforcement mechanism' for new small generators (i.e. not licenced generators)
2.	Member States and national regulatory authorities shall ensure that existing Power Generating Modules continue to be bound by such technical requirements that apply to them (including applicable derogations) pursuant to legislation in force in the respective Member States or contractual arrangements in force at the time of entry into force of this Network Code, including any provisions therein for the change of such requirements.									Decc/Ofgem need to ensure that existing requirements are maintained.
3.	Notwithstanding paragraph (1) and (2) the requirements set forth by this Network Code may be made applicable to Existing Power Generating Modules in a Member State, but only in case of factual change such as the evolution of system requirements including penetration of renewable energy sources, smart grids, distributed generation, demand response and taking account of the legitimate expectations of existing generating modules. The extent of the applicability of this Network Code to Existing Power Generating Modules shall be decided by the National Regulatory Authority following a proposal from the relevant TSO.						New process (for retrospectivity) in G-Code and D-Code /ER – maybe in existing Governance sections Potentially an additional obligation on existing generators / DNOs to provide information to TSOs to allow them to complete the CBA			Legislation required for NRA to have necessary powers
(a)	The Relevant TSO shall propose the application of this Network Code to Existing Power Generating Modules only following a public consultation.									
(b)	The proposal by the Relevant TSO shall be based on a sound and transparent quantitative Cost-Benefit Analysis. This Cost-Benefit Analysis shall be carried out in accordance with Article 33(1) to (5) and shall include									
	i. the costs to Existing Power Generating Modules of requiring compliance with this Network Code									
	ii. the socio-economic benefit of application of the requirements set forth by this Network Code									
	iii. The potential of alternative measures, including network improvements to achieve the required performance.									
(c)	The Relevant TSO shall only undertake the Cost-Benefit Analysis if an initial qualitative comparison of costs and benefits indicates that a subsequent analytical Cost-Benefit Analysis has a reasonable prospect of demonstrating positive cost-benefit. The initial qualitative comparison of costs and benefits shall in particular determine which there may be a viable case for application to Existing Power Generating Modules based on									
	i. the of sizes of Power Generating Modules; or									
	ii. types of Power Generating Modules or									
	iii. locations of Power Generating Modules or									

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iv. provisions of this Network Code.										
(d)	The Relevant TSO may propose to apply this Network Code to Existing Power Generating Modules every three years.									
(e)	The relevant TSO shall notify the launch of the procedure for re-assessment on its website. The date of notification on the website shall constitute the first day of the launch of the procedure for re-assessment. A public consultation shall be conducted in the frame of the procedure for re-assessment. Prior to the Relevant TSO carrying out the quantitative Cost-Benefit Analysis.									
(f)	The Relevant TSO must receive the approval of the national regulatory authority in accordance with Article 4(3) before undertaking a Cost-Benefit Analysis referred to in paragraph b. A period of at least three years must elapse between each cost benefit analysis.									
4.	With regard to Power Generating Modules not yet connected to the Network:									Ofgem to write / lead a one-off process
(a)	Within a delay not exceeding thirty months as from the day of entry into force of this Network Code, the Power Generating Facility Owner shall provide the Relevant Network Operator with a confirmation of final and binding contracts it has concluded for the construction, assembly or purchase of the main plant of a Power Generating Module with relevance to the provisions of this Network Code and which exists prior to the day, which is two years after the day of entry into force of this Network Code.									
(b)	The confirmation shall at least indicate the contract title, its date of signature and of entry into force, and the specifications of the main plant to be constructed, assembled or purchased.									
(c)	The Relevant Network Operator may request that the National Regulatory Authority confirms the existence, relevance and finality of such a contract, i.e. that its material terms can no longer be changed by one of the parties to the contract unilaterally and that no party to the contract has the right to terminate it at will. The Power Generating Facility Owner shall supply the National Regulatory Authority with all documents the National Regulatory Authority requests in order to ascertain that a binding and final contract exists.									
(d)	The Power Generating Module shall be considered as an Existing Power Generating Module, provided that:									
	(1) In accordance with Article 3(4) (a) and (b) above, the Relevant Network Operator is provided with sufficient evidence of the existence of binding and final contracts for the construction, assembly or purchase of the main plant of a Power Generating Module exists prior to the day, which is two years after the day of entry into force of this Network Code; or									
	(2) Following the verification performed by the National Regulatory Authority in accordance with Article 3(4) (c), it is ascertained that binding and final contracts for the construction, assembly or purchase of the main plant of a Power Generating Module exist prior to the day, which is two years after the day of entry into force of this Network Code.									

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(e) In case the Power Generating Facility Owner does not provide the Relevant Network Operator with the confirmation within the delay set forth in Article 3(4) (a), the Power Generating Module shall be considered as a New Power Generating Module.									
Article 3b									
Determination of significance									
1. The applicability and extent of the requirements with which a Power Generating Modules shall be required to comply shall be determined on the basis of the Voltage level of their Connection Point and their Maximum Capacity according to the categories set out in paragraph 2.						Scope statement in all documents where the requirements are placed e.g. G-Code, D-Code, Engineering Recommendations based on outcomes below.			
2. Power Generating Modules which are considered to be significant are categorized as follows:						Process outlined in Grid Code Output reflected in Scope / applicability of documents as required.			
(a) A Power Generating Module is of Type A if its Connection Point is below 110 kV and its Maximum Capacity is 0.8 kW or more									
(b) A Power Generating Module is of Type B if its Connection Point is below 110 kV and its Maximum Capacity is at or above a threshold defined by each Relevant TSO while respecting the provisions of Article 4(3). This threshold shall not be above the threshold for Type B Power Generating Modules according to table 1.									
(c) A Power Generating Module is of Type C if its Connection Point is below 110 kV and its Maximum Capacity is at or above a threshold defined by each Relevant TSO while respecting the provisions of Article 4(3). This threshold shall not be above the threshold for Type C Power Generating Modules according to table 1.									

Synchronous Area	maximum capacity threshold from which on a Power Generating Module is of Type B	maximum capacity threshold from which on a Power Generating Module is of Type C	maximum capacity threshold from which on a Power Generating Module is of Type D
Continental Europe	1 MW	50 MW	75 MW
Nordic	1.5 MW	10 MW	30 MW
Great Britain	1 MW	10 MW	30 MW
Ireland	0.1 MW	5 MW	10 MW
Baltic	0.5 MW	10 MW	15 MW

Table 1: Thresholds for Type B, C and D Power Generating Modules

(d) A Power Generating Module is of Type D if its Connection Point is at 110 kV or above. A Synchronous Power Generating Module or Power Park Module is of Type D as well if its Connection Point is below 110 kV and its Maximum Capacity is at or above a threshold defined by each Relevant TSO while respecting the provisions of Article 4(3). This threshold shall not be above the threshold for Type D Power Generating Modules according to table 1									
3. When TSOs define the thresholds pursuant to Paragraph 2 subparagraphs b, c and d, they shall:									

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
(a) Be based on accurate data, in this context Power Generating Facility Owners shall assist and contribute to the determination of the threshold and provide relevant data as requested by the Relevant TSO.									
(b) be coordinated with adjacent TSOs and DSOs									
(c) follow public consultation by the Relevant TSO									
(d) be subject to the approval of the National Regulatory Authority respecting the provisions of Article 4(3).									
4. The Relevant TSO shall have the right to re-assess the determination of the thresholds referred to in Paragraph 2 subparagraphs b, c and d if relevant circumstances have changed materially, but not more often than every three years and respecting the provisions of Article 4(3).									
Following any change to thresholds any Power Generating Module that has been moved to a new type will not automatically have to comply retroactively with the additional requirements but will be subject to the same procedure as applied to Existing Power Generating Modules in line with Article 3a									
Article 3c									
Application to Offshore synchronous power generating modules, pump storage power generating modules, combined heat and power facilities, and industrial sites									
1. Offshore connected Synchronous Power Generating Modules shall meet the requirements for onshore synchronous Power Generating Modules unless modified by the Relevant Network Operator while respecting the provisions of Article 4(3). The categories to be taken into account for Offshore Power Park Modules for the purpose of this Network Code are defined in Article 18(3).						Scope statement in all documents where the requirements are placed e.g. G-Code, D-Code, Engineering Recommendations			
2. Pump-storage Power Generating Modules shall fulfil all requirements in both generating and pumping operation mode. Synchronous Compensation Operation of Pump-Storage Power Generating Modules shall not be limited in time by technical design of the Power Generating Modules. Pump-Storage variable speed Power Generating Modules shall fulfil all requirements applicable to synchronous Power Generating Modules and in addition those set forth in Article 15(2) (b), if they are of Type B, C or D.						Scope statement in all documents where the requirements are placed e.g. G-Code, D-Code, Engineering Recommendations			
3. Without prejudice to the general applicability of the requirements set forth in this Network Code, a Power Generating Facility Owner, the Network Operator of an industrial site and the Relevant Network Operator to whose Network the Network of the industrial site is connected to, shall have the right in coordination with the Relevant TSO, with respect to Power Generation Modules which are embedded in the Networks of industrial sites, to agree while respecting the provisions of Article 4 (3) on conditions for disconnection of such Power Generating Modules together with critical loads, which secure production processes, from the Relevant Network Operator's Network. The only objective of such an agreement shall be to secure production processes of such a site in case of disturbed conditions in the Relevant Network Operator's Network. The requirements of this Network Code, notwithstanding such an agreement, shall apply to Power Generating Modules embedded in the Networks of such industrial sites.						Process in G-Code / D-Code			

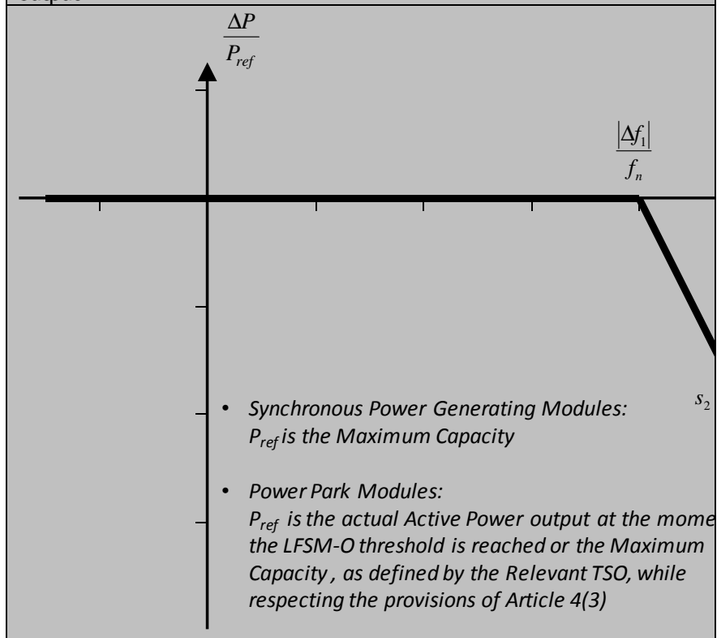
Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
4. Without prejudice to the general applicability of the requirements set forth in this Network Code, a requirement of this Network Code shall not apply to Power Generating Modules of facilities for combined heat and power production (CHP) embedded in the Networks of industrial sites in the following cumulative circumstances:						Scope statement in all documents where the requirements are placed e.g. G-Code, D-Code, Engineering Recommendations			
– the primary purpose of these facilities is to produce heat for production processes of this industrial site;									
– the generation of heat and power are rigidly coupled to each other, i. e. any change of heat generation results inadvertently in a change of Active Power generation and vice versa;									
– the Power Generating Modules are of Type A, B or C according to Article 3(6) (a) to (c); and									
– the requirement is related to the capability maintain constant Active Power output or to modulate Active Power output other than Article 8(1) (c) and (e).									
For the avoidance of doubt, combined heat and power generating facilities will be regarded on their electrical Maximum Capacity.									
Article 4									
Regulatory Aspects									
1. Where network operators or national regulatory authorities are required by this Network Code to determine or approve requirements they shall, in accordance with Directive 2009/72/EC, notably Art. 37 (1) and 6 thereof,						Change in Grid-Code, D-Code and Engineering Recommendation governance to allow this process / criteria to be applied			Maybe licence changes for Code objectives
(a) apply of the principles of proportionality and non-discrimination									
(b) ensure the maximum transparency									
(c) assign costs to the real originator of those costs to the extent possible									
(d) apply principle of optimisation between the highest overall efficiency and lowest total costs for all involved parties									
2. Network Operators shall respect the responsibility allocated to the Relevant TSO according to national legislation to ensure system security when taking decisions or entering into agreements with Power Generating Facility Owner in accordance with this code.									
Where appropriate further details to ensure that the first subparagraph is respected may be specified either by national legislation or in agreements between the Relevant TSO and the Network Operators in its Control Area.									
3. Where reference is made to this paragraph, the terms and conditions for connection and access to networks or their methodologies shall be established by the responsible National Regulatory Authorities, or, if applicable, by the Member States, in accordance with the rules of national law implementing Directive 2009/72/EC, notably Art. 37 (1) and 6 thereof, and with the principles of transparency, proportionality and non-discrimination.									

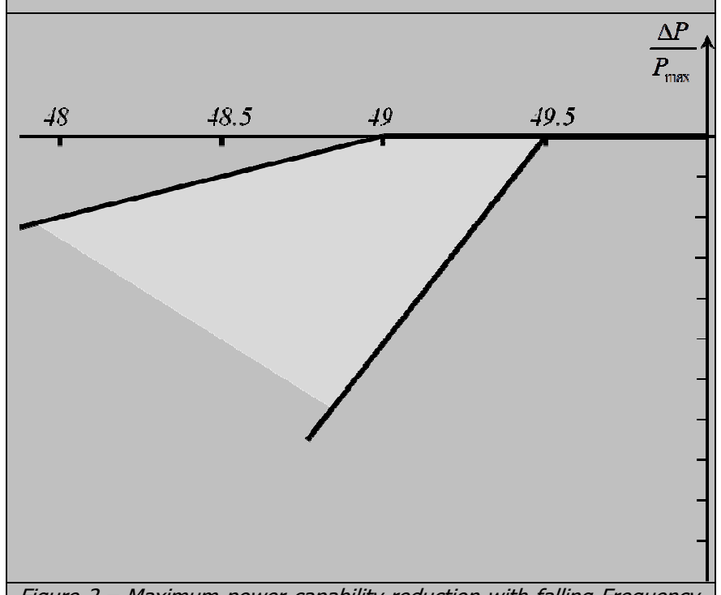
Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
Article 5									
Recovery of Costs									
The costs related to the obligations in this network code borne by regulated Network Operators shall be assessed by National Regulatory Authorities in line with Article 37 (1) of Directive 72/2009/EC. Network Operators shall, within three months of a request, provide such additional information as reasonably requested by National Regulatory Authorities to facilitate the assessment of the costs incurred. Costs assessed as efficient, reasonable and proportionate shall be recovered as determined by National Regulatory Authorities.									Ofgem to define approach.
Article 6									
Confidentiality Obligations [to be aligned to CACM]									
1. Each Relevant Network Operator, Relevant TSO, Relevant DSO or Relevant CDSO shall preserve the confidentiality of the information and data submitted to them in fulfilment of the obligations under this Network Code and shall use them exclusively for the purpose they have been submitted in compliance with this Network Code, notably to verify the compliance of requirements set forth in this Network Code.						Possible code changes to G-Code / D-Code arising from legal advice			Legal advice required. Broader issues of ensuring the GB requirements for data / confidentiality are acceptable with the EU requirements
2. Notwithstanding the above, disclosure of such information and data may occur a Relevant Network Operator, a Relevant TSO, Relevant DSO or a Relevant CDSO shall disclose information if required under EU or national law to disclose,. The disclosure shall be reported to the owner of such information and data.									
3. In case of disclosure for other purposes than those described in Article 6(1) or (2), a Relevant Network Operator, a Relevant TSO, Relevant DSO or a Relevant CDSO shall seek the consent of the owner of such information and data. This consent cannot be unreasonably withheld.									

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
Title 2									
REQUIREMENTS						Provisions of Article 4(3) need to refer to governance of Codes			
Chapter 1									
GENERAL REQUIREMENTS									
Article 8									
General requirements for type A power generating modules									
Type A Power Generating Modules shall fulfil the following requirements referring to Frequency stability**:**						Scope statement in all documents where the requirements are placed e.g. G-Code, D-Code, Engineering Recommendations			
1. With regard to Frequency ranges:									
(a) A Power Generating Module shall be capable of remaining connected to the Network and operating within the Frequency ranges and time periods specified by table 2.	DPC4.2.2 Frequency and Voltage ESQCR 27	5.3.1 Interface Protection Settings and Test Requirements	7.3.4 9.1.3 9.1.4 9.1.5 9.3.2 9.3.7 10.5.5 10.5.6	BSEN 50438 4.2.3 Continuous frequency operation range 4.2.4 Response to under-frequencies 4.2.5 Power response to over-frequency Requirements for gens: 4.4 Normal operating range 4.4.1 General 4.4.2 Operating frequency range	CC.6.1.3 – Frequency Range	Grid Code / D-Code			
(b) Respecting the provisions of Article 4(3), wider Frequency ranges or longer minimum times for operation may be agreed between the Relevant Network Operator in coordination with the Relevant TSO and the Power Generating Facility Owner to ensure the best use of the technical capabilities of a Power Generating Module if needed to preserve or to restore system security.	DOC9.4.1.1 DPC7.4.1.5 DPC7.4.3.6 DPC7.4.3.7		10.2 Protection Requirements	-	CC.6.3.12 – Narrower / Wider frequency range as agreed with NGET	Process in Grid Code / D-Code Requirements in Grid-Code / D-Code			
(c) The Power Generating Facility Owner shall not unreasonably withhold consent to apply wider Frequency ranges or longer minimum times for operation taking account of their economic and technical feasibility.						Grid Code / D-Code			

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
(d) Without prejudice to the provisions of Article 8(1) (a) point 1), a Power Generating Module shall be capable of automatic disconnection at specified frequencies, if required by the Relevant Network Operator. The terms and settings for automatic disconnection shall be agreed between the Relevant Network Operator and the Power Generating Facility Owner, respecting Article 4(3).					CC.6.3.13 – Disconnection outside 47 – 52Hz Frequency range	Process in Grid Code / D-Code Requirements in Grid-Code / D-Code			
2. With regard to the rate of change of Frequency withstand capability, a Power Generating Module shall be capable of staying connected to the Network and operating at rates of change of Frequency, other than triggered by rate-of-change-of-Frequency-type of loss of mains protection, up to a value defined by the Relevant TSO respecting the provisions of Article 4(3). This rate-of-change-of-Frequency-type of loss of mains protection will be defined by the Relevant Network Operator in coordination with the Relevant TSO and subject to notification to the National Regulatory Authority. The modalities of that notification shall be determined in accordance with the applicable national regulatory framework.	DPC7.4.3.4 DPC7.4.3.8	5.3.3 Frequency Drift and Step Change Stability Test	10.2 Protection Requirements 10.3.13 10.3.14 10.3.15	Requirements for gens: 4.5.2 Rate of change of frequency (ROCOF) immunity	CC.6.3.12 – Rate of change of Frequency relay settings agreed with NGET	Process in Grid Code / D-Code Requirements in Grid-Code / D-Code			

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft				Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
				D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
	Synchronous Area	Frequency Range	Time perio						Process in Grid Code / D-Code			
	Continental Europe	47.5 Hz – 48.5 Hz	To be defined by each provisions of Article m									
		48.5 Hz – 49.0 Hz	To be defined by each provisions of Article 4 period for 4									
		49.0 Hz – 51.0 Hz	Ur									
		51.0 Hz – 51.5 Hz	30									
	Nordic	47.5 Hz – 48.5 Hz	30									
		48.5 Hz – 49.0 Hz	To be defined by each provisions of Article m									
		49.0 Hz – 51.0 Hz	Ur									
		51.0 Hz – 51.5 Hz	30									
	Great Britain	47.0 Hz – 47.5 Hz	20									
		47.5 Hz – 48.5 Hz	90									
		48.5 Hz – 49.0 Hz	To be defined by each provisions of Article m									
		49.0 Hz – 51.0 Hz	Ur									
		51.0 Hz – 51.5 Hz	90									
		51.5 Hz – 52.0 Hz	15									
	Ireland	47.5 Hz – 48.5 Hz	90									
		48.5 Hz – 49.0 Hz	To be defined by each provisions of Article m									
		49.0 Hz – 51.0 Hz	Ur									
		51.0 Hz – 51.5 Hz	90									
	Baltic	47.5 Hz – 48.5 Hz	To be defined by each provisions of Article m									
		48.5 Hz – 49.0 Hz	To be defined by each provisions of Article 4 period for 4									
		49.0 Hz – 51.0 Hz	Ur									
		51.0 Hz – 51.5 Hz	To be defined by each provisions of Article m									
Table 2: Minimum time periods for which a Power Generating Module shall be capable of operating for different frequencies deviating from a nominal value without disconnecting from the Network.												
3. With regard to the Limited Frequency Sensitive Mode - Overfrequency (LFSM-O) the following shall apply:				DOC5.6.2.2				BC.3.7.2	Process in Grid Code			
(a) The Power Generating Module shall be capable of activating the provision of Active Power Frequency Response at a Frequency threshold and Droop settings determined by the Relevant TSO and notified to the National regulatory Authority. The precise modalities of that notification shall be determined in accordance with the applicable national regulatory framework.									Requirements in Grid-Code / D-Code			
(1) The Frequency threshold shall be between 50.2 Hz and 50.5 Hz inclusive												

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
(2) The Droop settings shall be between 2 – 12 %. .									
(3) The Power Generating Module shall be capable of activating Active Power Frequency Response as fast as technically feasible with an initial delay that shall be as short as possible and reasonably justified by the Power Generating Facility Owner to the Relevant TSO if greater than 2 seconds.									
(4) Respecting the provisions of Article 4(3) the relevant TSO may require that upon reaching Minimum Regulating Level the Power Generating Module shall be capable of either									
– continuing operation, or									
– further decreasing Active Power output									
 • *Synchronous Power Generating Modules: P_{ref} is the Maximum Capacity* • *Power Park Modules: P_{ref} is the actual Active Power output at the mome the LFSM-O threshold is reached or the Maximum Capacity , as defined by the Relevant TSO, while respecting the provisions of Article 4(3)*									
Figure 1: Active Power Frequency Response capability of Power Generating Modules in LFSM-O. P_{ref} is the reference Active Power to which ΔP is related and may be defined differently for Synchronous Power Generating Modules and Power Park Modules. ΔP is the change in Active Power output from the Power Generating Module. f_n is the nominal Frequency (50 Hz) in the Network and Δf is the Frequency change in the Network. At overfrequencies where Δf is above Δf_1 the Power Generating Module has to provide a negative Active Power output change according to the Droop S_2.									
(b) The Power Generating Module shall be capable of stable operation during LFSM-O operation. When LFSM-O is active, the LFSM-O Setpoint will prevail over any other Active Power Setpoints.									

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
4. The Power Generating Module shall be capable of maintaining constant output at its target Active Power value regardless of changes in Frequency, except where output follows the defined changes in output in the context of Article 8(1) (c), (e) or Article 10(2) (b), and Article 10(2) (c) as applicable.	DPC7.4.1.2	-	-	Requirements for generating plants 4.4.4 Continuous operating voltage range	CC.6.3.3, BC.3.5.2 and CC.6.3.9	Grid Code / D-Code			
5. The Relevant TSO shall define admissible Active Power reduction from maximum output with falling Frequency in their control zone as a rate of reduction falling within the boundaries, illustrated the full lines in Figure 2: – Below 49 Hz falling by a reduction rate of 2 % of the Maximum Capacity at 50 Hz per 1 Hz Frequency drop; – Below 49.5 Hz by a reduction rate of 10 % of the Maximum Capacity at 50 Hz per 1 Hz Frequency drop. The admissible Active Power reduction from maximum output defined shall – Clearly define the ambient conditions applicable – Take account of the technical capabilities of Power Generating Modules – be determined respecting Article 4(3)  *Figure 2 – Maximum power capability reduction with falling Frequency. The diagram represents the boundaries defined by the Relevant TSO while respecting the provisions of Article 4(3).*	-	-	-	BSEN 50438 4.2.4 Response to under-frequencies Requirements for generating plants 4.4.3 Minimal requirement for active power delivery at under-frequencies	CC.6.3.3	Process in Grid Code Requirements in Grid-Code / D-Code			

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
6. The Power Generating Module shall be equipped with a logic interface (input port) in order to cease Active Power output within 5 seconds following an Instruction from the Relevant Network Operator. The Relevant Network Operator shall have the right to define requirements for equipment to make this facility operable remotely while respecting the provisions of Article 4(3)	DOC6.3 DOC7.3 DOC7.4.1 DOC7.4.2				Not specified – Electronic and verbal Instructions given to BMU's and Large Power Stations	Obligation in **D-Code/G-Code** as appropriate. Procedure for how to use the right to issue instruction D-Code/G-Code Possible market implications, so may be consequential **BSC changes.**			
7. The Relevant TSO shall define while respecting the provisions of Article 4(3) the conditions under which a Power Generating Module shall be capable of connecting automatically to the Network. These conditions shall include: – Frequency ranges, within which an automatic connection is admissible, and a corresponding delay time – maximum admissible gradient of increase of Active Power output Automatic connection is allowed unless determined otherwise by the Relevant Network Operator in coordination with the Relevant TSO.	DPC7.3.1	5.3.4 Automatic Reconnection A1.3.5 Reconnection B1.3.5 Reconnection	10.2.3 10.5.14 11.5 Synchronizing and Operational Control	BSEN: 4.7 Connection and starting to generate electrical power 4.7.1 General 4.7.2 Automatic reconnection after tripping 4.7.4 Synchronisation Requirements for generating plants 4.10 Connection and starting to generate electrical power 4.10.1 General 4.10.2 Automatic reconnection after tripping 4.10.4 Synchronisation		Process in Grid Code Requirements in Grid-Code / D-Code			
Article 9									
General requirements for type B power generating modules									
1. Type B Power Generating Modules shall fulfil the requirements set out in Article 8.						Scope / Structure of documents			

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
2. Type B Power Generating Modules shall fulfil the following requirements referring to Frequency stability**:**	Applicable DCode sections as Article 8 (6)				Not specified – Electronic and verbal Instructions given to BMU's and Large Power Stations				
(a) In order to be able to control Active Power output, the Power Generating Module shall be equipped with an interface (input port) in order to be able to reduce Active Power output as instructed by the Relevant Network Operator or the Relevant TSO.						Obligation in **D-Code/G-Code** as appropriate. Procedure for how to use the right to issue instruction D-Code/G-Code Possible market implications, so may be consequential **BSC changes.**			
(b) Respecting the provisions of Article 4(3) the Relevant Network Operator shall have the right to define the requirements for further equipment to make this facility operable remotely.						Process in Grid Code Requirements in Grid-Code / D-Code			
3. Type B Power Generating Modules shall fulfil the following requirements referring to robustness of Power Generating Modules :	DPC7.4.4 Fault Ride Through and Phase Voltage Unbalance		10.5.3 Under Voltage 13.6.1 System Stability	Requirements for gens: 4.5.3 Low voltage ride through (LVRT) 4.5.3.1 General 4.5.3.2 PV generating plant Generating plant with converter connected generating technology 4.5.3.3 Generating plant with directly coupled generating technology	CC.6.3.15	Process in Grid Code / D-Code Requirements in Grid-Code / D-Code			
(a) With regard to fault-ride-through capability of Power Generating Modules:									
(1) Power Generating Modules shall be capable of staying connected to the Network and continuing stable operation after the power system has been disturbed by Secured Faults in accordance with a voltage-against-time-profile at the Connection Point for fault conditions on the defined by the Relevant TSO respecting the provisions of Article 4(3).									
(2) The voltage-against-time-profile shall be expressed by a lower limit of the course of the phase-to-phase Voltages on the Network Voltage level at the Connection Point during a symmetrical fault, as a function of time before, during and after the fault.									
(3) This lower limit shall be defined by the Relevant TSO respecting the provisions of Article 4(3) using parameters set out in figure 3 and within the ranges set out in tables 3.1 and 3.2.									
(4) Having regard to the fact that generality with regard to pre-fault operating conditions of Power Generating Modules sets constraints on fault clearance time for successful fault-ride-through performance and that longer fault clearance times sets constraints on pre-fault operating conditions for successful fault-ride-through performance, each TSO shall define and make publicly available while respecting the provisions of Article 4(3) defining the pre-fault and post-fault conditions for the fault-ride-through capability in terms of:									
– conditions for the calculation of the pre-fault minimum short circuit capacity at the Connection Point;									

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
– conditions for pre-fault active and Reactive Power operating point of the Power Generating Module at the Connection Point and Voltage at the Connection Point; and									
– Conditions for the calculation of the post-fault minimum short circuit capacity at the Connection Point.									
(5) Upon request by a Power Generating Facility Owner a Relevant Network Operator shall provide the pre-fault and post-fault conditions to be considered for fault-ride-through capability as an outcome of the calculations at the Connection Point as defined in subparagraph 3 regarding:									
– pre-fault minimum short circuit capacity at each Connection Point expressed in MVA;									
– pre-fault operating point of the Power Generating Module expressed in Active Power output and Reactive Power output at the Connection Point and Voltage at the Connection Point; and									
– post-fault minimum short circuit capacity at each Connection Point expressed in MVA.									
Alternatively generic values for the above conditions derived from typical cases may be provided by the Relevant Network Operator.									

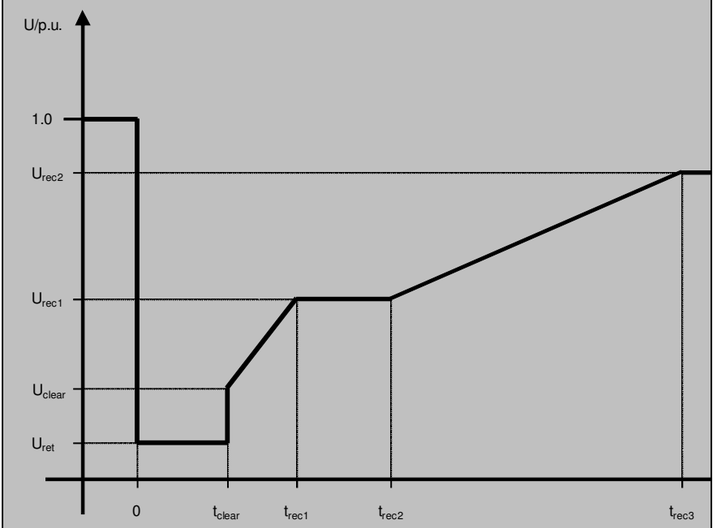



Figure 3 – Fault-ride-through profile of a Power Generating Module. The diagram represents the lower limit of a voltage-against-time profile by the Voltage at the Connection Point, expressed by the ratio of its actual value and its nominal value in per unit before, during and after a fault. U_{ret} is the retained Voltage at the Connection Point During a fault, t_{clear} is the instant when the fault has been cleared. U_{rec1}, U_{rec2}, t_{rec1}, t_{rec2} and t_{rec3} specify certain points of lower limits of Voltage recovery after fault clearance.									

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft				Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
				D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
	Voltage parameters [pu]		**Time parameters [seconds]**									
	U_{ret}:	0.05 – 0.3	t_{clear}:	0.14 – 0.15 (or 0.25 if system protection and secure operation requires)								
	U_{clear}:	0.7 – 0.9	t_{rec1}:	t_{clear}								
	U_{rec1}:	U_{clear}	t_{rec2}:	t_{rec1} – 0.7								
	U_{rec2}:	0.85 – 0.9 and ≥ U_{clear}	t_{rec3}:	t_{rec2} – 1.5								
Table 3.1 – Parameters for figure 3 for fault-ride-through capability of Synchronous Power Generating Modules.												
	Voltage parameters [pu]		**Time parameters [seconds]**									
	U_{ret}:	0.05 – 0.15	t_{clear}:	0.14 – 0.15 (or 0.25 if system protection and secure operation requires)								
	U_{clear}:	U_{ret} – 0.15	t_{rec1}:	t_{clear}								
	U_{rec1}:	U_{clear}	t_{rec2}:	t_{rec1}								
	U_{rec2}:	0.85	t_{rec3}:	1.5 – 3.0								
Table 3.2 – Parameters for figure 3 for fault-ride-through capability of Power Park Modules.												
(6) The Power Generating Module shall be capable of remaining connected to the Network and continuing stable operation when the actual course of the phase-to-phase Voltages on the Network Voltage level at the Connection Point during a symmetrical fault, given the pre-fault and post-fault conditions according to Article 9(3) (a) points 3) and 4), remains above the lower limit defined in Article 9(3) (a) point 2), unless the protection scheme for internal electrical faults requires the disconnection of the Power Generating Module from the Network. The protection schemes and settings for internal electrical faults shall be designed not to jeopardize fault-ride-through performance.												
(7) While still respecting Article 9(3) (a) point 5), undervoltage protection (either fault-ride-through capability or minimum Voltage defined at the connection point Voltage) shall be set by the Power Generating Facility Owner to the widest possible technical capability of the Power Generating Module unless the Relevant Network Operator requires less wide settings according to Article 9(5) (b). The settings shall be justified by the Power Generating Facility Owner in accordance with this principle.												
(b) Fault-ride-through capabilities in case of asymmetrical faults shall be defined by each TSO while respecting the provisions of Article 4(3).												
4. Type B Power Generating Modules shall fulfil the following requirement referring to system restoration:						10.2.3	Requirements	Not specified – Electronic and				

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
(a) With regard to capability of reconnection after an incidental disconnection due to a Network disturbance, respecting the provisions of Article 4(3) the Relevant TSO shall define the conditions under which a Power Generating Module shall be capable of reconnecting to the Network after an incidental disconnection has taken place due to a Network disturbance.			10.5.14 11.5 Synchronizing and Operational Control	for gens 4.10 Connection and starting to generate electrical power 4.10.1 General 4.10.2 Automatic reconnection after tripping 4.10.4 Synchronisation	verbal Instructions given to BMU's and Large Power Stations	Process in Grid Code Requirements in Grid-Code / D-Code			
(b) Installation of automatic reconnection systems shall be subject to prior authorization by the Relevant Network Operator subject to reconnection conditions specified by the Relevant TSO.						Requirements in Grid-Code / D-Code			
5. Type B Power Generating Modules shall fulfil the following general system management requirements:									
(a) With regard to control schemes and settings	DPC 7.2.2 DPC7.2.3		9.3.4 9.5.1 9.5.6		For Directly Connected Generators - specified through appropriate clauses in the Grid Code, Bilateral Connection Agreement and appropriate commissioning procedures such as TP106.	Process in Grid Code / D-Code Requirements in Grid-Code / D-Code			
(1) While respecting the provisions of Article 4(3), schemes and settings of the different control devices of the Power Generating Module relevant for transmission system stability and to enable emergency actions shall be coordinated and agreed between the Relevant TSO, the Relevant Network Operator and the Power Generating Facility Owner.									
(2) While respecting the provisions of Article 4(3), any changes to the schemes and settings of the different control devices of the Power Generating Module, relevant for transmission system stability and to enable emergency actions, shall be coordinated and agreed between the Relevant TSO, the Relevant Network Operator and the Power Generating Facility Owner, in particular if they concern the circumstances referred to under Article 9(5) (a) point 1).									
(b) With regard to electrical protection schemes and settings:	DPC4.4.4 Protection DPC6.3 Protection Requirements DPC7.4.3 Protection Requirements DPC7.4.4 Fault		10.6 Typical Protection Application Diagrams 11.3 Site Responsibility Schedule	Req for gens The interface protection system has following main objectives: • prevent the power production of the generating plant to result in an overvoltage situation in the distribution network it is connected to.	For Directly Connected Generators - Protection requirements are defined under CC.6.2.2, with further details specified in the Bilateral Agreement and finally through the Commissioning Panel process of TP106.	Process in Grid Code / D-Code Requirements in Grid-Code / D-Code			
(1) The Relevant Network Operator shall define the schemes and settings necessary to protect the Network taking into account the characteristics of the Power Generating Module. While respecting the provisions of Article 4(3), protection schemes relevant for the Power Generating Module and the Network and settings relevant for the Power Generating Module shall be coordinated and agreed between the Relevant Network Operator and the Power Generating Facility Owner. The protection schemes and settings for internal electrical faults shall be designed not to jeopardize the performance of a Power Generating Module according to this Network Code requirements otherwise.									

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
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(2) Electrical protection of the Power Generating Module shall take precedence over operational controls taking into account system security, health and safety of staff and the public and mitigation of the damage to the Power Generating Module.	Ride Through and Phase Voltage Unbalance DPC7.4.5 System Stability			Such overvoltages could cause damages to equipment connected to the distribution network as well as the distribution 1245 network itself; Interface protection and setting is detailed					
(3) Protection schemes may protect against the following aspects:									
– external and internal short circuit;									
– asymmetric load (Negative Phase Sequence);									
– stator and rotor overload;									
– over-/underexcitation;									
– over-/undervoltage at the Connection Point;									
– over-/undervoltage at the Alternator terminals;									
– inter-area oscillations;									
– inrush Current;									
– asynchronous operation (pole slip);									
– protection against inadmissible shaft torsions (for example, subsynchronous resonance);									
– Power Generating Module line protection;									
– unit transformer protection;									
– backup schemes against protection and switchgear malfunction;									
– overfluxing (U/f);									
– inverse power;									
– rate of change of Frequency; and									
– neutral Voltage displacement.									
(4) While respecting the provisions of Article 4(3), Changes to the protection schemes relevant for the Power Generating Module and the Network and to the setting relevant for the Power Generating Module shall be agreed between the Network Operator and the Power Generating Facility Owner and be concluded prior to the introduction of changes.									
(c) With regard to priority ranking of protection and control, the Power Generating Facility Owner shall organize its protections and control devices in compliance with the following priority ranking (from highest to lowest):									
(1) Network system and Power Generating Module protection;									
(2) Synthetic Inertia, if applicable;									
(3) Frequency control (Active Power adjustment);									
(4) Power Restriction; and									
(5) Power gradient constraint.									
(d) With regard to information exchange:					Operational				

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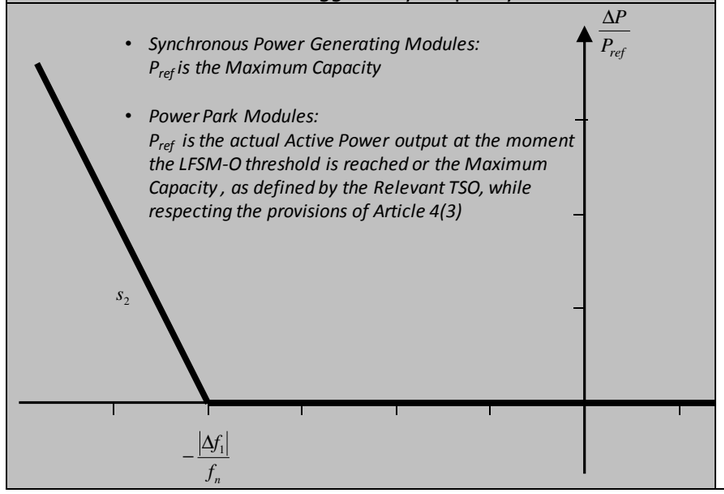
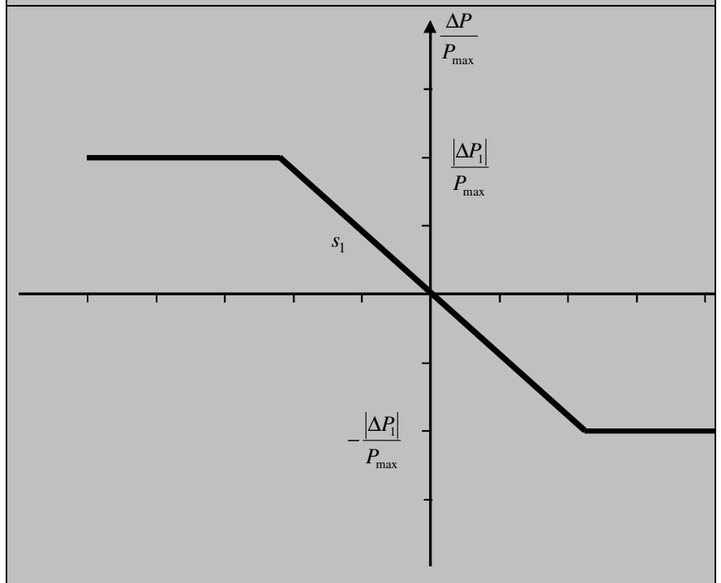
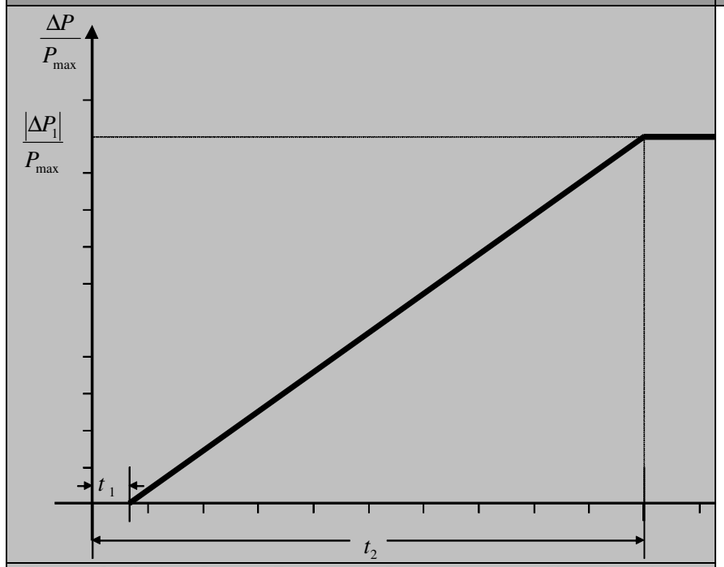
(1) Power Generating Facilities shall be capable of exchanging information between the Power Generating Facility Owner and the Relevant Network Operator and/or the Relevant TSO in real time or periodically with time stamping as defined by the Relevant Network Operator and/or the Relevant TSO while respecting the provisions of Article 4(3).					Metering requirements specified under CC.6.5.6 and the Bilateral Connection Agreement.				
(2) The Relevant Network Operator in coordination with the Relevant TSO shall define while respecting the provisions of Article 4(3) the contents of information exchanges and the precise list and time of data to be facilitated.									
Article 10									
General requirements for Type C power generating modules									
1. Type C Power Generating Modules shall fulfil the requirements listed in Articles 8 and 9, except Article[2] 8(1) (f) and Article 9(2) (a).						Scope statement in all documents where the requirements are placed e.g. G-Code, D-Code, Engineering Recommendations			
2. Type C Power Generating Modules shall fulfil the following requirements referring to Frequency stability:	Applicable DCode sections as Article 8 (6)			Annex C (informative) C.2 Frequency Sensitive Mode					
(a) With regard to Active Power controllability and control range, the Power Generating Module control system shall be capable of adjusting an Active Power Setpoint as instructed to the Power Generating Facility Owner by the Relevant Network Operator or the Relevant TSO.					CC.6.3.6(a), CC.6.3.7, CC.6.3.12 and CC.A.3 Limited Frequency Sensitive Mode Under Frequency is not covered under the Grid Code	Process in Grid Code / D-Code Requirements in Grid-Code / D-Code			
The Relevant Network Operator or the Relevant TSO shall define the period within which the adjusted Active Power set point must be reached. The relevant TSO shall define within a tolerance (subject to the availability of the prime mover resource) applying to the new Setpoint and the time within which it shall be reached. Manual, local measures shall be possible in the case that any automatic remote control devices are out of service.									
The Relevant Network Operator or the Relevant TSO shall notify the period within the adjusted Active Power set point is to be reached and the tolerance level to the National Regulatory Authority. The modalities of that notification shall be determined in accordance with the applicable national regulatory framework.									
(b) In addition to Article 8(1) (c) the following requirements shall apply to Type C Power Generating Modules with regard to Limited Frequency Sensitive Mode – Underfrequency (LFSM-U):									
(1) The Power Generating Module shall be capable of activating the provision of Active Power Frequency Response at a Frequency threshold and with a Droop determined by the Relevant TSO									

[2] Currently no Article 8(1)f in RFG. Likely a typo.

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
– The Frequency threshold determined by the TSO shall be between 49.8 Hz and 49.5 Hz inclusive									
– The Droop settings determined by the TSO shall be between 2 – 12 %.									
This is represented graphically at figure 4.									
(2) When determining the frequency threshold and droop requirements applicable to generators the relevant TSO shall take account of the fact that actual delivery of Active Power Frequency Response in LFSM-U mode depends on.									
– ambient conditions when the response is to be triggered									
– the operating conditions of the Power Generating Module, in particular limitations on operation near Maximum Capacity at low frequencies according to Article 8(1) (e) and									
– the availability primary energy sources.									
(3) The frequency threshold and a Droop determined by the TSO notified to the national regulatory authority. The precise modalities of that notification shall be determined in accordance with the applicable national regulatory framework.									
(4) The activation of Active Power Frequency Response by the Power Generating Module shall not be unduly delayed. This delay shall be justified by the Power Generating Facility Owner to the Relevant TSO if greater than 2 seconds.									
(5) In the LFSM-U mode the Power Generating Module shall be capable of providing a power increase up to its Maximum Capacity.									
(6) Stable operation of the Power Generating Module during LFSM-U operation shall be ensured. The LFSM-U reference Active Power shall be the Active Power output at the moment of activation of LFSM-U and shall not be changed unless triggered by frequency restoration action									
• *Synchronous Power Generating Modules:* P_{ref} *is the Maximum Capacity* • *Power Park Modules:* P_{ref} *is the actual Active Power output at the moment the LFSM-O threshold is reached or the Maximum Capacity , as defined by the Relevant TSO, while respecting the provisions of Article 4(3)*  									

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
Figure 4: Active Power Frequency Response capability of Power Generating Modules in LFSM-U. P_{ref} is the reference Active Power to which ΔP is related and may be defined differently for Synchronous Power Generating Modules and Power Park Modules. ΔP is the change in Active Power output from the Power Generating Module. f_n is the nominal Frequency (50 Hz) in the Network and Δf is the Frequency change in the Network. At underfrequencies where Δf is below Δf_1 the Power Generating Module has to provide a positive Active Power output change according to the Droop S_2.									
(c) In addition to Article 10(2) (b) the following shall apply cumulatively, when operating in Frequency Sensitive Mode (FSM):									
(1) The Power Generating Module shall be capable of providing Active Power Frequency Response in accordance with the parameters specified by each TSO within the ranges shown in table 4 (an illustrative example provided in figure 5). In specifiying those paramaters the TSO shall take account of the tact that									
– In case of overfrequency the Active Power Frequency Response is limited by the Minimum Regulating Level.									
– In case of underfrequency the Active Power Frequency Response is limited by Maximum Capacity.									
– The actual delivery of Active Power Frequency Response depends on the operating and ambient conditions of the Power Generating Module when this response is triggered, in particular limitations on operation near Maximum Capacity at low frequencies according to Article 8(1) (e) and available primary energy sources.									
									

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
Figure 5: Active Power Frequency Response capability of Power Generating Modules in FSM illustrating the case of zero deadband and insensitivity. P_{max} is the Maximum Capacity to which ΔP is related. ΔP is the change in Active Power output from the Power Generating Module. f_n is the nominal Frequency (50 Hz) in the Network and Δf is the Frequency deviation in the Network.									
Parameters Active Power range related to Maximum Capacity $\frac{\lvert\Delta P_1\rvert}{P_{max}}$ Frequency Response Insensitivity $\lvert\Delta$ / $\frac{\lvert\Delta}{f}$ Frequency Response Deadband Droop s_1									
Table 4: Parameters for Active Power Frequency Response in FSM (explanation for figure 5)									
(2) The Frequency Response Deadband of Frequency deviation and Droop must be able to be reselected subsequently (without requiring to be online or remote).									
(3) As a result of a frequency step change, the Power Generating Module shall be capable of activating full Active Power Frequency Response, at or above the full line according to figure 6 in accordance with the parameters specified by each TSO (aiming at avoiding Active Power oscillations for the Power Generating Module) within the ranges according to table 5. The combination of choice of the parameters according specified by the TSO shall take into account possible technology dependent limitations.									
(4) The initial activation of full Active Power Frequency Response required in accordance with this paragraph shall not be unduly delayed.									
If the delay in initial activation of full Active Power Frequency Response is greater than 2 seconds the Power Generating Facility Owner shall provide technical evidence setting out why a longer time is needed.									
For generation technologies without inertia, the Relevant TSO, respecting the provisions of Article 4(3), may specify a shorter time than 2 seconds for which the Power Generating Facility Owner is required to provide technical evidence setting out why a longer time is needed for the initial activation of full Active Power Frequency Response.									

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
 *Figure 6: Active Power Frequency Response capability. P_{max} is the Maximum Capacity to which ΔP is related. ΔP is the change in Active Power output from the Power Generating Module. The Power Generating Modules have to provide Active Power Output ΔP up to the point ΔP_1 in accordance with the times t_1 and t_2 with the values of ΔP_1, $t_1$and t_2 being specified by the Relevant TSO according to Table 5. t_1 is the initial delay. t_2 is the time for full activation.*									
(5) The Power Generating Module shall be capable of providing full Active Power Frequency Response for a period between 15 min and 30 min specified by the relevant TSO. In specifying the period the TSO shall have regard to Active Power headroom and primary energy source of the Power Generating Module.									
(6) Within the time limits of Article 10(2) (c) point 6), Active Power control shall not have any adverse impact on the Frequency response of Power Generating Units.									
(7) The parameters specified by the TSO in accordance with sub paragraphs 1, 3 and 5 shall be notified to the National Regulatory Authority. The modalities of that notification shall be determined in accordance with the applicable national regulatory framework.									

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
Parameters / **Ranges or values** Active Power range related to Maximum Capacity (Frequency response range) $\frac{\lvert\Delta P_1\rvert}{P_{max}}$ — 1.5 – 10 % Maximum admissible initial delay t_1 unless justified otherwise for generation technologies with Inertia — 2 seconds Maximum admissible initial delay t_1 unless justified otherwise for generation technologies without Inertia — as specified by the Relevant TSO while respecting the provisions of Article 4(3) Maximum admissible choice of full activation time t_2, unless longer activation times are admitted by the Relevant TSO due to system stability reasons — 30 seconds Table 5: Parameters for full activation of Active Power Frequency Response resulted from Frequency step change (explanation for figure 6).									
(d) With regard to Frequency restoration control, the Power Generating Module shall provide functionalities compliant to specifications defined by the Relevant TSO while respecting the provisions of Article 4(3), aiming at restoring Frequency to its nominal value and/ or maintain power exchange flows between control areas at their scheduled values.									
(e) With regard to disconnection due to underfrequency, Power Generating Facilities capable of acting as a load, including hydro Pump-Storage Power Generating Facilities, shall be capable of disconnecting its load in case of underfrequency. This requirement does not extent to auxiliary supply.					CC.6.3.3 (d) applies to HVDC Plant OC6.6 applies to Non Embedded Customers including Pumped Storage Plant	Grid-Code / D-Code	Interpreting this to include closed-loop pumped storage.		
(f) With regard to real-time monitoring of FSM:					Ancillary Services Monitoring covered under OC5.4.1(c) and the Bilateral Agreement	Process in Grid Code / D-Code			
(1) To monitor the operation of Active Power Frequency Response the communication interface shall be equipped to transfer on-line from the Power Generating Facility to the Network control centre of the Relevant Network Operator and/or the Relevant TSO on request by the Relevant Network Operator and/or the Relevant TSO at least the following signals:						Requirements in Grid-Code / D-Code			
– status signal of FSM (on/off);									
– scheduled Active Power output;									
– actual value of the Active Power output;									
– actual parameter settings for Active Power Frequency Response;									
– Droop and dead band.									

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(2) The Relevant Network Operator and the Relevant TSO shall define while respecting the provisions of Article 4(3) additional signals to be provided by the Power Generating Facility for monitoring and/or recording devices in order to verify the performance of the Active Power Frequency Response provision of participating Power Generating Modules.									
3. With Regard to Voltage stability Type C Power Generating Modules shall be capable of automatic disconnection when Voltage at the Connection Point reaches levels specified by the Relevant Network Operator in coordination with the relevant TSO.	DPC7.4.3.2 DPC7.4.3.3		10.5.3 Under Voltage 10.5.4 Over Voltage			Process in Grid Code / D-Code Requirements in Grid-Code / D-Code			
The terms and settings for actual automatic disconnection of Power Generating Modules shall be defined by the Relevant Network Operator in coordination with the Relevant TSO while respecting the provisions of Article 4(3).									
4. Type C Power Generating Modules shall fulfil the following requirements referring to robustness of Power Generating Modules	DPC7.5.4.4 DPC7.4.3 Protection Requirements DPC7.4.3.1 Co-ordinating with Existing Protection		13.6 Additional Information Relating to System Stability Studies 13.6.3 Power System Stabilizers 9.1.3 10.5.13		CC.6.3.15 covers maintenance of stability during faults CC.6.3.3 and CC.6.3.4 covers maintenance of active power during nominal voltage and frequency changes. CC.6.3.10 and CC.6.3.15.3 (ii) covers the ability of the Generator to withstand the negative phase sequence loading incurred by system back up protection	Grid-Code / D-Code			
(a) In case of power oscillations, Power Generating Modules shall retain Steady-state Stability when operating at any operating point of the P-Q-Capability Diagram.									
(b) Without prejudice to Article 8(1) (e), Power Generating Modules shall be capable of remaining connected to the Network and operating without power reduction, as long as Voltage and Frequency remain within the specified limits pursuant to this Regulation.									
(c) Power Generating Modules shall be capable of withstanding single-phase or three-phase auto-reclosures on meshed Network lines, if applicable to the Network to which they are connected. Details of this capability shall be subject to coordination and agreements on protection schemes and settings according to Article 9(5) (b).									
5. Type C Power Generating Modules shall fulfil the following requirements referring to system restoration:	Black Start Station: A Power Station which is registered pursuant to a CUSC Bilateral Agreement with NGC, as having a Black Start Capability. DPC7.4.8 DOC9.1.1 DOC9.4.1.4		9.2.5		CC.6.3.5 and Black Start Contracts	Grid-Code D-Code Black Start contracts Maybe consequential change to CUSC and Black Start Contracts			
(a) With regard to Black Start Capability:									
(1) Black Start Capability is not mandatory.									
(2) Power Generating Facility Owners shall provide a quotation for providing Black Start Capability if the Relevant TSO requests such a quotation. The Relevant TSO may make such a request if it considers system security to be at risk due to a lack of Black Start Capability in its Control Area.									
(3) A Power Generating Module with a Black Start Capability shall be able to start from shut down without any external electrical energy supply within a timeframe determined by the Relevant Network Operator in coordination with the Relevant TSO while respecting the provisions of Article 4(3).									

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(4) A Power Generating Module with a Black Start Capability shall be able to synchronise within the Frequency limits defined in Article 8(1) and Voltage limits defined by the Relevant Network Operator or defined by Article 11(2) where applicable.	DOC9.4.1.5 DOC9.4.3.7 DOC9.5 Re-synchronisation of De-synchronised Islands								
(5) A Power Generating Module with a Black Start Capability shall be capable of automatically regulating dips of Voltage caused by load connections.									
(6) A Power Generating Module with a Black Start Capability shall:									
– be capable of regulating load connections in block load;									
– control Frequency in case of overfrequency and underfrequency within the whole Active Power output range between Minimum Regulating Level and Maximum Capacity as well as at houseload level;									
– be capable of parallel operation of a few Power Generating Modules within one island; and									
– control Voltage automatically during the system restoration phase.									
(b) With regard to capability to take part in Island Operation:									
(1) Power generating modules shall be capability of taking part in Island Operation, if required by the Relevant Network Operator in coordination with the Relevant TSO while respecting the provisions of Article 4(3)									
– The Frequency limits for island operation shall be those defined in accordance with Article 8(1).									
– The Voltage limits for island operation in accordance with to Article 10(3) or Article 11(2) where applicable.									
(2) Power Generating Modules shall be able to operate in FSM during Island Operation, as defined in Article 10(2) (b).									
In the case of a power surplus, Power Generating Modules shall be capable of reducing the Active Power Output from its previous operating point to any new operating point within the P-Q-Capability Diagram. In this regard the Power generating Module shall be capable of reducing Active Power output to at least 55 % of its Maximum Capacity.									
(3) The method of detection of change from interconnected system operation to Island Operation shall be agreed between the Power Generating Facility Owner and the Relevant Network Operator in coordination with the Relevant TSO while respecting the provisions of Article 4(3). The agreed method of detection may not rely solely on the Network Operator's switchgear position signals.									
(c) With regard to quick re-synchronization capability:									

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(1) In case of disconnection of the Power Generating Module from the Network, the Power Generating Module shall be capable of quick re-synchronization capability in line with the protection strategy agreed between the Relevant Network Operator in coordination with the Relevant TSO and the Power Generation Facility Owner in the event of disturbances to the system.									
(2) A Power Generating Module with a minimum re-synchronization time after its disconnection from any external power supply greater than 15 minutes shall be designed to trip to houseload from any operating point in its P-Q-Capability Diagram. In this case the identification of houseload operation shall not be based solely on the Network Operator's switchgear position signals.									
(3) Power Generating Modules shall be capable of continuing operation following tripping to houseload, irrespective of any auxiliary connection to the external Network. The minimum operation time shall be defined by the Relevant Network Operator in coordination with the Relevant TSO taking into consideration the specific characteristics of the prime mover technology.									
6. Type C Power Generating Modules shall fulfil the following general system management requirements**:**						Process in Grid Code / D-Code			
(a) With regard to loss of angular stability or loss of control, a Power Generating Module shall be capable of disconnecting automatically from the Network in order to support preservation of system security and/or to prevent damage from the Power Generating Module. The Power Generating Facility Owner and the Relevant Network Operator in coordination with the Relevant TSO shall agree on the criteria to detect loss of angular stability or loss of control.	DPC7.4.2 Control Arrangements DPC7.4.5.3		9.7.6		CC.6.2.2.3.4 and Bilateral Connection Agreements	Requirements in Grid-Code / D-Code			
(b) With regard to instrumentation:					CC6.5.6				
(1) Power Generating Facilities shall be equipped with a facility to provide fault recording and dynamic system behaviour monitoring of the following parameters:									GENERAL: "Distribution vs Transmssion" aginst the 110Kv in RFG. Need to work out how this work in the new world and the code structure.
– Voltage;									
– Active Power;									
– Reactive Power; and									

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
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– Frequency.									
The Relevant Network Operator shall have the right to define while respecting the provisions of Article 4(3) quality of supply parameters to be complied with provided a reasonable prior notice is given.									
(2) While respecting the provisions of Article 4 (3), the settings of the fault recording equipment, including triggering criteria and the sampling rates shall be agreed between the Power Generating Facility Owner and the Relevant Network Operator in coordination with the Relevant TSO.					CC.6.6.1 and through the Bilateral Agreement				Query over Relevant Network Operators; for example – different requirements depending on which NEtwork you are connected to, for example a 132KV in Scotland is T-Connection; 132KV in E+W is D-connected.
(3) The dynamic system behaviour monitoring shall include an oscillation trigger, specified by the Relevant Network Operator in coordination with the Relevant TSO, detecting poorly damped power oscillations.									
(4) The facilities for quality of supply and dynamic system behaviour monitoring shall include arrangements for the Power Generating Facility Owner, the Relevant Network Operator and/or the Relevant TSO to access the information. While respecting the provisions of Article 4 (3) the communications protocols for recorded data shall be agreed between the Power Generating Facility Owner and the Relevant Network Operator and Relevant TSO.									
(c) With regard to the simulation models:	DPC 7.3.3(a) DPC7.3.1		6.3.6 6.3.7 6.3.8 6.3.9 6.3.10		Specified through the Planning Code and Data Registration Code				
(1) Power Generating Facility Owner shall provide simulation models which properly reflect the behaviour of the Power Generating Module in both steady-state and dynamic simulations (50 Hz component) or in electromagnetic transient simulations when requested by the Relevant Network Operator.									

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
(2) The models provided by the Power Generating Facility Owner shall contain the following sub-models, depending on the existence of the mentioned components:									
– Alternator and prime mover;									
– Speed and power control;									
– Voltage control, including, if applicable, Power System Stabilizer (PSS) function and Excitation Control System;									
– Power Generating Module protection models as agreed between the Relevant Network Operator and the Power Generating Facility Owner, while respecting the provisions of Article 4(3); and									
– Converter models for Power Park Modules.									
(3) The request to by the Relevant Network Operator referred to in the first subparagraph shall be coordinated with the relevant TSO and respect the provisions of article 4(3). It shall include:									
– the format in which models shall be provided									
– the provision of documentation of models structure and block diagrams									
– an estimate of the minimum and maximum short circuit capacity at the connection point, expressed in MVA, as an equivalent of the Network.									
The Relevant Network Operator or Relevant TSO shall verify the models provided against the results of compliance tests referred to in Title 4 Chapters 2, 3 and 4.									
The models shall be used verify compliance of Power Generating Modules with the requirements of this Network Code including but not limited to Compliance Simulations as of Title 4 Chapters 5, 6 and 7 and for use in studies for continuous evaluation in system planning and operation.									
(4) The Power Generating Facility Owner shall provide Power Generating Module recordings to the Relevant Network Operator or Relevant TSO if requested while respecting the provisions of Article 4(3). The Relevant Network Operator or Relevant TSO may make such a request, while respecting the provisions of Article 4(3) in order to compare the response of the models with such recordings.									
(d) With regard to the installation of devices for system operation and/or security, if the Relevant Network Operator or the Relevant TSO considers additional devices necessary to be installed in a Power Generating Facility in order to preserve or restore system operation or security, the Relevant Network Operator or Relevant TSO and the Power Generating Facility Owner shall investigate this request and, while respecting the provisions of Article 4(3), agree on an appropriate solution.	DPC7.5.4.4		9.1.3 9.2.3 9.2.4 9.2.5		BCA	CUSC for changes to Bilateral agreements			

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
(e) The Relevant Network Operator in coordination with the Relevant TSO shall define while respecting the provisions of Article 4(3) minimum and maximum limits on rates of change of Active Power output (ramping limits) in both up and down direction for a Power Generating Module taking into consideration the specific characteristics of the prime mover technology.					BC1.A.1.1	Process in Grid Code / D-Code Requirements in Grid-Code / D-Code			
(f) Earthing arrangement of the neutral-point at the Network side of step-up transformers shall be in accordance with the specifications of the Relevant Network Operator.	DPC4.4.2 Earthing		8 EARTHING 8.1 General 8.1.1 The earthing arrangements of the Generating Plant shall satisfy the requirements of DPC4 of the Distribution Code. Specific requirements for HV and LV connected generating plant given		CC.6.3.11	Process in Grid Code / D-Code Requirements in Grid-Code / D-Code			
(g) Power Generating Facility Owners intending to change plant and equipment of the Power Generating Module that may have an impact on the grid connection and on the interaction, such as turbines, Alternators, converters, high-voltage equipment, protection and control systems (hardware and software), shall notify such changes in advance the Relevant Network Operator in case it is reasonable to foresee that these intended changes may be affected by the requirements of this Network Code	DPC7.5.4 DPC8.2.2		Changes at the Installation		Limited - PC.4.4	Process in Grid Code / D-Code Requirements in Grid-Code / D-Code		What is the process for 'existing' generators that significantly change. They aren't caught by this article as they weren't "new" in the first place.	
(h) Before the proposed changes are implemented sshall, while respecting the provisions of Article 4(3), agree on these requirements are implemented with the Relevant Network Operator in coordination with the Relevant TSO. In case of modernisation or replacement of equipment in existing Power Generating Modules the new equipment shall comply with the respective requirements which are relevant to the planned work. While respecting the provisions of Article 4 (3), the use of existing spare components that do not comply with the requirements has to be agreed with the Relevant Network Operator in coordination with the Relevant TSO in each case.	DGC11.2		12.6.3 12.6.4			Process in Grid Code / D-Code Requirements in Grid-Code / D-Code			

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
Article 11									
GENERAL REQUIREMENTS FOR TYPE D POWER GENERATING MODULES									
1. In addition to fulfilling the requirements listed in Article 8, excluding Article 8(1) (f), (g), Article 9, excluding Article 9(2) (a) and Article 10 excluding Article 10(3) (a), and, Type D Power Generating Modules shall fulfil the requirements in this Article unless referred to otherwise in this Article.						Scope statement in all documents where the requirements are placed e.g. G-Code, D-Code, Engineering Recommendations			
2. Type D Power Generating Modules shall fulfil the following requirements referring to Voltage stability:					CC.6.1.4	Process in Grid Code / D-Code			
(a) With regard to Voltage ranges:	ESQCR:		9.5 Voltage Limits and Control			Requirements in Grid-Code / D-Code			
(1) While still respecting the provisions according to Articles 9(3) (a) and 11(3) (a), a Power Generating Module shall be capable of staying connected to the Network and operating within the ranges of the Network Voltage at the Connection Point, expressed by the Voltage at the Connection Point related to nominal Voltage (per unit), and the time periods specified by tables 6.1 and 6.2.	Declaration of phases, frequency and voltage at supply terminals		9.5.1						
(2) Notwithstanding the first subparagraph the Relevant TSO in Spain may require power generating modules to remain connected to the network in the voltage range between 1.05 pu – 1.0875 pu for an unlimited period	27.								

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
Synchronous Area / **Voltage Range** Continental Europe: 0.85 pu – 0.90 pu; 0.90 pu – 1.118 pu; 1.118 pu – 1.15 pu Nordic: 0.90 pu – 1.05 pu; 1.05 pu – 1.10 pu Great Britain: 0.90 pu–1.10 pu Ireland: 0.90 pu – 1.118 pu Baltic: 0.85 pu – 0.90 pu; 0.90 pu – 1.12 pu; 1.12 pu – 1.15 pu Table 6.1: This table shows the minimum time periods a Power Generating Module shall be capable of operating for Voltages deviating from the nominal value at the Connection Point without disconnecting from the Network. (The Voltage base for pu values is from 110 kV to 300 kV (excluding).)									
Synchronous Area / **Voltage Range** Continental Europe: 0.85 pu – 0.90 pu; 0.90 pu – 1.05 pu; 1.05 pu – 1.10 pu Nordic: 0.90 pu – 1.05 pu; 1.05 pu – 1.10 pu Great Britain: 0.90 pu – 1.05 pu; 1.05 pu – 1.10 pu Ireland: 0.90 pu – 1.05 pu Baltic: 0.88 pu – 0.90 pu; 0.90 pu – 1.10 pu; 1.10 pu – 1.15 pu Table 6.2: This table shows the minimum time periods a Power Generating Module shall be capable of operating for Voltages deviating from the nominal value at the Connection Point without disconnecting from the Network. (The Voltage base for pu values is from 300 kV to 400 kV.)									
(b) In order to ensure the best use of the technical capabilities of a Power Generating Module if needed to preserve or to restore system security.	DPC4.2.3.1		10.1.3 10.2 Protection Requirements						
(1) While respecting the provisions of Article 4(3), wider Voltage ranges or longer minimum times for operation may be agreed between the Relevant Network Operator in coordination with the Relevant TSO and the Power Generating Facility Owner									

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
(2) If wider Voltage ranges or longer minimum times for operation are economically and technically feasible, the Power Generating Facility Owner shall not be unreasonably withhold agreement.									
(c) Without prejudice sub paragraph (a), the Relevant Network Operator in coordination with the Relevant TSO shall have the right to specify, while respecting the provisions of Article 4(3), Voltages at the Connection Point at which a Power Generating Module shall be capable of automatic disconnection. The terms and settings for automatic disconnection shall be agreed between the Relevant Network Operator and the Power Generating Facility Owner, while respecting the provisions of Article 4(3).									
3. Type D Power Generating Modules shall fulfil the following requirements referring to robustness of Power Generating Modules:					CC.6.3.15	Process in Grid Code / D-Code Requirements in Grid-Code / D-Code			
(a) With regard to fault-ride-through capability of Power Generating Modules:									
(1) The Power generating Module shall be capable of operating in accordance with a voltage-against-time-profile defined by the TSO, while respecting the provisions of Article 4(3).									
The voltage-against-time-profile defined by the TSO shall be set using parameters in figure 3 according to tables 7.1 and 7.2 except for Power Generating Modules connected to the Transmission Network									
The voltage-against-time-profile defined by the TSO shall be set using parameters in figure 3 according to tables 3.1 and 3.2 except for Power Generating Modules connected to the Distribution Network									
(2) Each TSO shall define, while respecting the provisions of Article 4(3), the pre-fault and post-fault conditions for the fault-ride-through capability according to Article 9(3) (a) point 3). The defined pre-fault and post-fault conditions for the fault-ride-through capability shall be made publicly available.									
Voltage parameters [pu]		**Time parameters [seconds]**							
U_{ret}:	0	t_{clear}:	0.14 – 0.15 (or 0.25 if system protection and operational security require)						
U_{clear}:	0.25	t_{rec1}:	t_{clear} – 0.45						
U_{rec1}:	0.5 – 0.7	t_{rec2}:	t_{rec1} – 0.7						
U_{rec2}:	0.85 – 0.9	t_{rec3}:	t_{rec2} – 1.5						
Table 7.1 – Parameters for figure 3 for fault-ride-through capability of Synchronous Power Generating Modules.									
Voltage parameters [pu]		**Time parameters [seconds]**							
U_{ret}:	0	t_{clear}:	0.14 – 0.15 (if system protection and operational security require)						
U_{clear}:	U_{ret}	t_{rec1}:	t_{clear}						
U_{rec1}:	U_{clear}	t_{rec2}:	t_{rec1}						
U_{rec2}:	0.85	t_{rec3}:	1.5 – 3.0						
Table 7.2 – Parameters for figure 3 for fault-ride-through capability of Power Park Modules.									

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
(b) Each Relevant Network Operator shall provide on request by the Power Generating Facility Owner the pre-fault and post-fault conditions to be considered for fault-ride-through capability as an outcome of the calculations at the Connection Point as defined in Article 9 (3) (a) point 3) regarding:									
– pre-fault minimum short circuit capacity at each Connection Point expressed in MVA;									
– pre-fault operating point of the Power Generating Module expressed in Active Power output and Reactive Power output at the Connection Point and Voltage at the Connection Point; and									
– post-fault minimum short circuit capacity at each Connection Point expressed in MVA.									
(c) Fault-ride-through capabilities in case of asymmetrical faults shall be defined by each TSO while respecting the provisions of Article 4(3).									
4. Type D Power Generating Modules shall fulfil the following general system management requirements:	DPC7.3.1		11.5 Synchronizing and Operational Control		Specified in Bilateral Connection Agreement	TBC		Too hard. Feels like central dispatch. Not clear where this goes. How does this work in principal.	
(a) With regard to synchronization, when starting a Power Generating Module, synchronization shall be performed by the Power Generating Facility Owner only after authorization by the Relevant Network Operator.									
(b) The Power Generating Module shall be equipped with the necessary synchronization facilities.									
(c) Synchronization of Power Generating Modules shall be possible at frequencies within the ranges set out in table 2.									
(d) While respecting the provisions of Article 4(3), the Relevant Network Operator and the Power Generating Facility Owner shall agree on the settings of synchronization devices to be concluded prior to operation of the Power Generating Module. This agreement shall address:									
– Voltage,									
– Frequency,									
– phase angle range,									
– phase sequence,									
– deviation of Voltage and Frequency.									
Chapter 2									
REQUIREMENTS FOR SYNCHRONOUS POWER GENERATING MODULES									
Article 12									
Requirements for Type B synchronous power generating modules									
1. In addition to fulfilling the requirements listed in Articles 8 and 9, Type B Synchronous Power Generating Modules shall fulfil the requirements in this Article.						Scope statement in all documents where the requirements are placed e.g. G-Code, D-Code, Engineering Recommendations			

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
2. Type B Synchronous Power Generating Modules shall fulfil the following requirements referring to Voltage stability:						Grid-Code / D-Code			
(a) With regard to Reactive Power capability the Relevant Network Operator shall have the right to define while respecting the provisions of Article 4(3) the capability of a Synchronous Power Generating Module to provide Reactive Power.					CC.6.3.2(a)				
(b) With regard to the Voltage control system, a Synchronous Power Generating Module shall be equipped with a permanent automatic excitation control system in order to provide constant Alternator terminal Voltage at a selectable Setpoint without instability over the entire operating range of the Synchronous Power Generating Module.					CC.6.3.8(a)(i)				
3. Type B Synchronous Power Generating Modules shall fulfil the following requirements referring to robustness of Power Generating Modules and post fault Active Power recovery after fault-ride-through, the Relevant TSO shall define while respecting the provisions of Article 4(3) magnitude and time for Active Power recovery the Power Generating Module shall be capable of providing.					CC.6.3.15	Process in Grid Code / D-Code Requirements in Grid-Code / D-Code			
Article 13									
Requirements for Type C Synchronous power generating modules									
1. In addition to fulfilling the requirements listed in Articles 8, 9, 10 and 12, except for Article 8(1) (f), Article 9(2) (a) and Article 12(2) (a), Type C Synchronous Power Generating Modules shall fulfil the requirements in this Article.						Scope statement in all documents where the requirements are placed e.g. G-Code, D-Code, Engineering Recommendations			
2. Type C Synchronous Power Generating Modules shall fulfil the following requirements referring to Voltage stability:					CC.6.3.2(a)				
(a) With regard to Reactive Power Capability, for Synchronous Power Generating Modules where the Connection Point is not at the location of the high-voltage terminals of the step-up transformer to the Voltage level of the Connection Point nor at the Alternator terminals, if no step-up transformer exists, supplementary Reactive Power may be defined by the Relevant Network Operator, while respecting the provisions of Article 4(3), to compensate for the Reactive Power demand of the high-voltage line or cable between these two points from the responsible owner of this line or cable.						Process in Grid Code / D-Code Requirements in Grid-Code / D-Code			
(b) With regard to Reactive Power capability at Maximum Capacity:									

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
(1) While respecting the provisions of Article 4(3), the Relevant Network Operator in coordination with the Relevant TSO shall define the Reactive Power provision capability requirements in the context of varying Voltage. For this purpose the Relevant Network Operator shall define a U-Q/P_{max}-profile within the boundaries of which the Synchronous Power Generating Module shall be capable of providing Reactive Power at its Maximum Capacity. The defined U-Q/P_{max} profile may take any shape having regard to the potential costs for power generating modules of delivering the capability of providing reactive power production at high voltages and reactive power consumption at low voltages.									
(2) The U-Q/P_{max}-profile shall be defined by the Relevant Network Operator in coordination with the Relevant TSO while respecting the provisions of Article 4(3) in conformity with the following principles:									
– the U-Q/P_{max}-profile shall not exceed the U-Q/P_{max}-profile envelope, represented by the inner envelope in figure 7;									
– the dimensions of the U-Q/P_{max}-profile envelope (Q/P_{max} range and Voltage range) are defined for each Synchronous Area in table 8; and									
– the position of the U-Q/P_{max}-profile envelope within the limits of the fixed outer envelope in figure 7.									
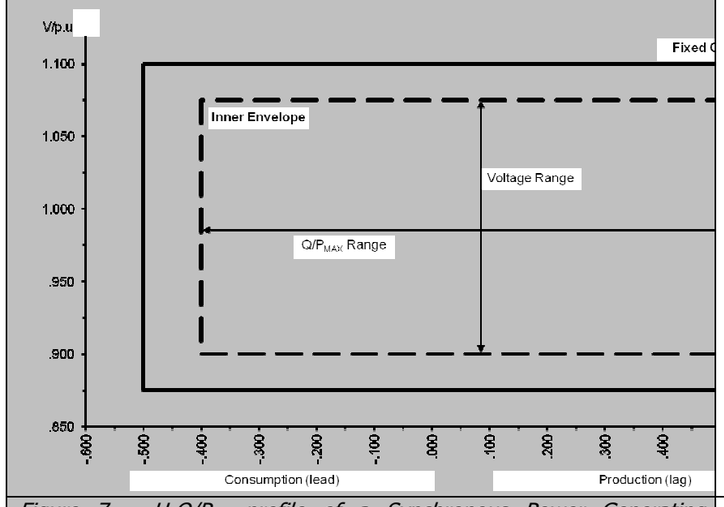									
Figure 7 – U-Q/P_{max}-profile of a Synchronous Power Generating Module. The diagram represents boundaries of a U-Q/P_{max}-profile by the Voltage at the Connection Point, expressed by the ratio of its actual value and its nominal value in per unit, against the ratio of the Reactive Power (Q) and the Maximum Capacity (P_{max}). The position, size and shape of the inner envelope are indicative.									

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
Synchronous Area / **Maximum range of Q/P_{max}** / **Maximum range of steady-state Voltage level in PU** Continental Europe: 0.95 / 0.225 Nordic: 0.95 / 0.150 Great Britain: 0.95 / 0.100 Ireland: 1.08 / 0.218 Baltic States: 1.0 / 0.220 Table 8: Parameters for the inner envelope in figure 7									
(3) The Reactive Power provision capability requirement applies at the Connection Point. For profile shapes other than rectangular, the Voltage range represents the highest and lowest values. The full Reactive Power range is therefore not expected to be available across the range of steady-state Voltages.									
(4) The Synchronous Power Generating Module shall be capable of moving to any operating point within its U-Q/P_{max} profile in appropriate timescales to target values requested by the Relevant Network Operator.									
(c) With regard to Reactive Power capability below Maximum Capacity, when operating at an Active Power output below the Maximum Capacity ($P<P_{max}$), the Synchronous Power Generating Modules shall be capable of operating in every possible operating point in the P-Q Capability Diagram of the Alternator of this Synchronous Power Generating Module at least down to Minimum Stable Operating Level. Even at reduced Active Power output, Reactive Power supply at the Connection Point shall fully correspond to the P-Q-Capability Diagram of the Alternator of this Synchronous Power Generating Module, taking the auxiliary supply power and the Active and Reactive Power losses of the step-up transformer, if applicable, into account.									
Article 14									
Requirements[3] for Type C synchronous power generating modules									
1. In addition to fulfilling the requirements listed in Articles 8, 9, 10, 11, 12 and 13, except for Article 8(1) (f), Article 9(2) (a), Article 10(3) (a), and Article 12(2), Type D Synchronous Power Generating Modules shall fulfil the requirements in this Article.						Scope statement in all documents where the requirements are placed e.g. G-Code, D-Code, Engineering Recommendations			
2. Type D Synchronous Power Generating Modules shall fulfil the following requirements referring to Voltage stability:					CC.6.3.8 and CC.A.6				
(a) While respecting the provisions of Article 4(3), the parameters and settings of the components of the Voltage control system shall be agreed between the Power Generating Facility Owner and the Relevant Network Operator in coordination with the Relevant TSO						If specified through BCA: CUSC /DCUSA			
(b) The agreement referred to in sub paragraph (a) shall include:									

[3] Should refer to Type D; likely a typo.

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
(1) specifications and performance of an Automatic Voltage Regulator (AVR) with regards to steady-state Voltage and transient Voltage control;									
(2) specifications and performance of the Excitation Control System:									
– bandwidth limitation of the output signal to ensure that the highest Frequency of response cannot excite torsional oscillations on other Power Generating Modules connected to the Network;									
– an Underexcitation Limiter to prevent the Automatic Voltage Regulator from reducing the Alternator excitation to a level which would endanger synchronous stability;									
– an Overexcitation Limiter to ensure that the Alternator excitation is not limited to less than the maximum value that can be achieved whilst ensuring the Synchronous Power Generating Module is operating within its design limits;									
– a stator Current limiter; and									
– a PSS function to attenuate power oscillations, if the Synchronous Power Generating Module size is above a value of Maximum Capacity defined by the Relevant TSO while respecting the provisions of Article 4(3).									
3. While respecting the provisions of Article 4 (3), the Relevant TSO and the Power Generating Facility Owner shall enter into an agreement regarding technical capabilities of the Power Generating Module to aid angular stability under fault conditions.								A 132kV generator at Distribution doesn't say Relevant Network Operator. A new mechanism may be required between 132kV connected and NGET. Licence / code you sign up to.	Requirement for agreement between TSO and 132kV distribution connected generators to enforce requirements
Chapter 3									
REQUIREMENTS FOR POWER PARK MODULES									
Article 15									
REQUIREMENTS FOR TYPE B POWER PARK MODULES									
1. In addition to fulfilling the general requirements listed in Articles 8 and 9, Type B Power Park Modules shall fulfil the requirements in this Article.						Scope statement in all documents where the requirements are placed e.g. G-Code, D-Code, Engineering Recommendations			
2. Type B Power Park Modules shall fulfil the following requirement referring to Voltage stability:						Process: Grid-Code / D-Code			
(a) With regard to Reactive Power capability the Relevant Network Operator shall have the right to define while respecting the provisions of Article 4(3) the capability of a Power Park Module to provide Reactive Power.					CC.6.3.2 (c)	Requirements: Grid-Code / D-Code			
(b) The Relevant Network Operator in coordination with the Relevant TSO shall have the right to require while respecting the provisions of Article 4(3) the capability of a Power Park Module to provide Fast Fault Current at the Connection Point in case of symmetrical (3-phase) faults.					CC.6.3.15				

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
(1) In this regard, the Power Park Module shall be capable of activating the supply of Fast Fault Current either by:									
– ensuring the supply of the Fast Fault Current at the Connection Point, or									
– by measuring Voltage deviations at the terminals of the individual units of the Power Park Module and providing a Fast Fault Current at the terminals of these units.									
(2) The Relevant Network Operator in coordination with the Relevant TSO shall while respecting the provisions of Article 4(3) specify									
– how and when a Voltage deviation is to be determined as well as the end of the Voltage deviation,									
– the characteristics of the Fast Fault Current,									
– the timing and accuracy of the Fast Fault Current, which may include several stages.									
(c) With regard to the supply of Fast Fault Current in case of asymmetrical (1-phase or 2-phase) faults the Relevant Network Operator in coordination the Relevant TSO shall have the right to introduce while respecting the provisions of Article 4(3) a requirement for asymmetrical current injection.					CC.6.3.15				
3. Type B Power Park Modules shall fulfil the following requirements referring to robustness of Power Generating Modules:									
(a) The Relevant TSO shall specify the post-fault Active Power recovery the Power Park Module shall be capable of providing while respecting the provisions of Article 4(3), In this regard, the Relevant TSO shall specify									
(1) when the post-fault Active Power recovery begins based on a Voltage criterion,									
(2) a maximum allowed time for Active Power recovery, and									
(3) a magnitude and accuracy for Active Power recovery.									
(b) The specifications shall be in accordance to the following principles:									
(1) priority between Fast Fault Current requirements according to Article 15 (2) b) and c) and Active Power recovery									
(2) dependence between Active Power recovery times and duration of Voltage deviations,									
(3) a defined limit of the maximum allowed time for Active Power recovery,									
(4) adequacy between the level of Voltage recovery and the minimum magnitude for Active Power recovery, and									
(5) adequate damping of Active Power oscillations.									

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
Article 16									
Requirements for Type C power park modules									
1. In addition to fulfilling the requirements listed in Articles 8, 9, 10 and 15, except for Article 8(1) (f), Article 9(2) (a), and Article 15(2) (a) unless referred to otherwise in Article 16(3) (d) points 3) and 4), Type C Power Park Modules shall fulfil the requirements in this Article.						Scope statement in all documents where the requirements are placed e.g. G-Code, D-Code, Engineering Recommendations			
2. Type C Power Park Modules shall fulfil the following requirements referring to Frequency stability the Relevant TSO shall have the right to require, while respecting the provisions of Article 4(3), that Power Park Modules be capable of providing Synthetic Inertia to a low Frequency event.					Not currently captured in GB Grid Code but assessed under Grid Code Frequency Response Technical Subgroup and Frequency Response Working Group.	Process: D-Code / Grid Code Output: D-Code / Grid-Code			
The operating principle of control systems installed to provide synthetic inertia and the associated performance parameters shall be defined by the Relevant TSO while respecting the provisions of Article 4(3).									
3. Type C Power Park Modules shall fulfil the following requirements referring to Voltage stability:						Process: D-Code / Grid Code Output: D-Code / Grid-Code			
(a) With regard to Reactive Power Capability, for Power Park Modules where the Connection Point is not at the location of the high-voltage terminals of its step-up transformer nor at the terminals of the high-voltage line or cable to the Connection Point at the Power Park Module, if no step-up transformer exists, supplementary Reactive Power may be required by the Relevant Network Operator while respecting the provisions of Article 4(3) to compensate for the Reactive Power demand of the high-voltage line or cable between these two points from the responsible owner of this line or cable.					CC.6.3.2(c) and CC.6.3.4				
(b) With regard to Reactive Power capability at Maximum Capacity**:**									
(1) The Relevant Network Operator in coordination with the Relevant TSO shall define while respecting the provisions of Article 4(3) the Reactive Power provision capability requirements in the context of varying Voltage. For doing so, it shall define a U-Q/P_{max}-profile that shall take any shape within the boundaries of which the Power Park Module shall be capable of providing Reactive Power at its Maximum Capacity.									
(2) The U-Q/P_{max}-profile shall be defined by each Relevant Network Operator in coordination with the Relevant TSO while respecting the provisions of Article 4(3) in conformity with the following principles:									
– the U-Q/P_{max}-profile shall not exceed the U-Q/P_{max}-profile envelope, represented by the inner envelope in figure 8,									
– the dimensions of the U-Q/P_{max}-profile envelope (Q/P_{max} range and Voltage range) shall be within the values defined for each Synchronous Area in table 9; and									

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
– the position of the U-Q/P_{max}-profile envelope within the limits of the fixed outer envelope in figure 8.									
– The defined U-Q/P_{max} profile may take any shape having regard to the potential costs for power generating modules of delivering the capability of providing reactive power production at high voltages and reactive power consumption at low voltages.									
-									
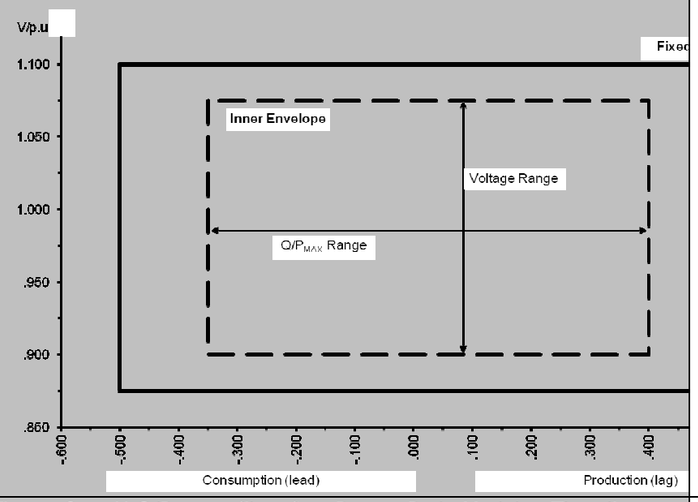									
Figure 8 – U-Q/P_{max}-profile of a Power Park Module. The diagram represents boundaries of a U-Q/P_{max}-profile by the Voltage at the Connection Point, expressed by the ratio of its actual value and its nominal value in per unit, against the ratio of the Reactive Power (Q) and the Maximum Capacity (P_{max}). The position, size and shape of the inner envelope are indicative.									
Synchronous Area / **Maximum range of Q/P_{max}** / **Maximum range of steady-state Voltage level in PU** Continental Europe / 0.75 / 0.225 Nordic / 0.95 / 0.150 Great Britain / 0.66 / 0.100 Ireland / 0.66 / 0.218 Baltic States / 0.80 / 0.220 Table 9: Parameters for the inner envelope in figure 8									
(3) The Reactive Power provision capability requirement applies at the Connection Point. For profile shapes other than rectangular, the Voltage range represents the highest and lowest values. The full Reactive Power range is therefore not expected to be available across the range of steady-state Voltages.									
(c) With regard to Reactive Power capability below Maximum Capacity:									

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
(1) The Relevant Network Operator in coordination with the Relevant TSO shall define while respecting the provisions of Article 4(3) the Reactive Power provision capability requirements. For doing so, it shall define a P-Q/P_{max}-profile that shall take any shape within the boundaries of which the Power Park Module shall be capable of providing Reactive Power below Maximum Capacity.									
(2) The P-Q/P_{max}-profile is defined by each Relevant Network Operator in coordination with the Relevant TSO while respecting the provisions of Article 4(3), in conformity with the following principles:									
– the P-Q/P_{max}-profile shall not exceed the P-Q/P_{max}-profile envelope, represented by the inner envelope in figure 9;									
– the Q/P_{max} range of the P-Q/P_{max}-profile envelope is defined for each Synchronous Area in table 9;									
– the Active Power range of the P-Q/P_{max}-profile envelope at zero Reactive Power shall be 1 pu;									
– the P-Q/P_{max}-profile can be of any shape and shall include conditions for Reactive Power capability at zero Active Power; and									
– the position of the P-Q/P_{max}-profile envelope within the limits of the fixed outer envelope in figure 9.									
– The defined U-Q/P_{max} profile may take any shape having regard to the potential costs for power generating modules of delivering the capability of providing reactive power production at high voltages and reactive power consumption at low voltages.									
(3) When operating at an Active Power output below the Maximum Capacity ($P<P_{max}$), the Power Park Module shall be capable of providing Reactive Power at any operating point inside its P-Q/P_{max}-profile, if all units of this Power Park Module, which generate power, are technically available (i. e. not out-of-service due to maintenance or failure). Otherwise the Reactive Power capability may be less taking into consideration the technical availabilities.									

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
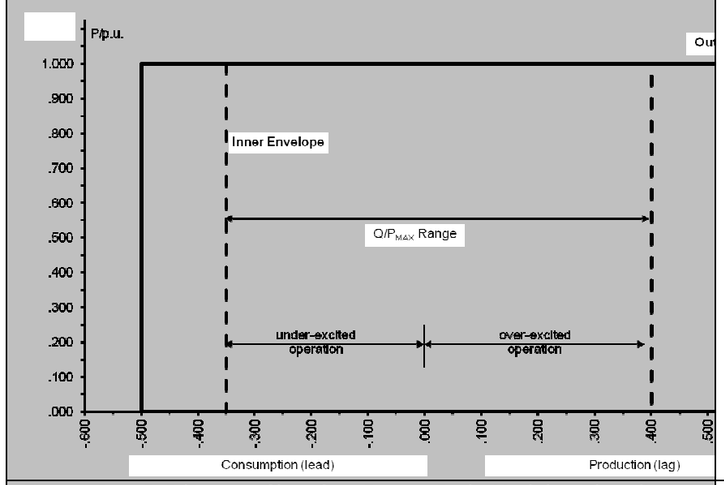									
Figure 9 - P-Q/P_{max}-profile of a Power Park Module. The diagram represents boundaries of a P-Q/P_{max}-profile at the Connection Point by the Active Power, expressed by the ratio of its actual value and the Maximum Capacity in per unit, against the ratio of the Reactive Power (Q) and the Maximum Capacity (P_{max}). The position, size and shape of the inner envelope are indicative.									
(4) The Power Park Module shall be capable of moving to any operating point within its P-Q/P_{max} profile in appropriate timescales to target values requested by the Relevant Network Operator.									
(d) With regard to Reactive Power control modes:					CC.6.3.2(b),CC.6.3.8, CC.A.7 and BC2.11.2	Process: D-Code / Grid Code Output: D-Code / Grid-Code			
(1) The Power Park Module shall be capable of providing Reactive Power automatically by either Voltage Control mode, Reactive Power Control mode or Power Factor Control mode.									
(2) For the purposes of Voltage Control mode, the Power Park Module shall be capable of contributing to Voltage control at the Connection Point by provision of Reactive Power exchange with the Network with a Setpoint Voltage covering at least 0.95 to 1.05 pu in steps no greater than 0.01 pu with a Slope with a range of at least 2 to 7 % in steps no greater than 0.5 %. The Reactive Power output shall be zero when the grid Voltage value at the Connection Point equals the Voltage Setpoint.									
(3) The Setpoint may be operated with or without a deadband selectable in a range from zero to +-5 % of nominal Network Voltage in steps no greater than 0.5 %.									

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft		Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
		D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
(4)	Following a step change in Voltage, the Power Park Module shall be capable of achieving 90 % of the change in Reactive Power output within a time t_1 to be specified by Relevant Network operator while respecting the provisions of Article 4(3) in the range of 1 - 5 seconds and settle at the value defined by the operating Slope within a time t_2 to be specified by Relevant Network Operator while respecting the provisions of Article 4(3) in the range of 5 - 60 seconds, with a steady-state reactive tolerance no greater than 5 % of the maximum Reactive Power.									
(5)	For the purposes of Reactive Power Control mode, the Power Park Module shall be capable of setting the Reactive Power Setpoint anywhere in the Reactive Power range, defined by Article 15(2) (a) and by Article 16(3) (a) and (b), with setting steps no greater than 5 Mvar or 5 % (whichever is smaller) of full Reactive Power, controlling the Reactive Power at the Connection Point to an accuracy within +-5 Mvar or +-5 % (whichever is smaller) of the full Reactive Power.									
(6)	For the purposes of Power Factor Control mode, the Power Park Module shall be capable of controlling the Power Factor at the Connection Point within the required Reactive Power range, defined by the Relevant Network Operator according to Article 15(2) (a) or defined by Article 16(3) (a) and (b), with a target Power Factor in steps no greater than 0.01. The Relevant Network Operator shall define while respecting the provisions of Article 4(3) the target Power Factor value and the tolerance expressed in Mvar or % on the Reactive Power value issued from conversion of Power Factor value, within a period of time, following a sudden change of Active Power output.									
(7)	The Relevant Network Operator in coordination with the Relevant TSO shall define while respecting the provisions of Article 4(3) which of the above three reactive power control mode options and associated Setpoints shall apply and further equipment to make the adjustment of the relevant Setpoint operable remotely.									
(e)	With regard to priority to Active or Reactive Power contribution, the Relevant TSO shall define while respecting the provisions of Article 4(3), whether Active Power contribution or Reactive Power contribution has priority during faults for which fault-ride-through capability is required. If priority is given to Active Power contribution, its provision shall be established no later than 150 ms from the fault inception.					CC.6.3.15	Process: D-Code / Grid Code Output: D-Code / Grid-Code			

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
(f) With regard to power oscillations damping control, if required by the Relevant TSO, while respecting the provisions of Article 4(3), a Power Park Module shall be capable of contributing to damping power oscillations. The voltage and reactive power control characteristics of Power Park Modules shall not adversely affect the damping of power oscillations.					Specified in Bilateral Agreement is required. Generally a Power System Stabiliser is not required to be fitted to a wind farm.	Process: Grid Code Output: Grid Code / D-Code Possibly CUSC if in Bilateral			
Article 17									
Requirements for Type D power park modules									
Type D Power Park Modules shall fulfil the requirements listed in Articles 8, 9, 10, 11, 15 and 16, except for Article 8(1) (f), Article 9(2) (a), Article 10(3) (a), and Article 15(2) (a).						Scope statement in all documents where the requirements are placed e.g. G-Code, D-Code, Engineering Recommendations			
Chapter 4									
REQUIREMENTS FOR OFFSHORE POWER PARK MODULES									
Article 18									
General Provisions									
1. The requirements in this Chapter apply to the connection to the Network of Power Park Modules located offshore. A Power Park Module located offshore which does not have an Offshore Connection Point shall be considered as an Onshore Power Park Module and thus shall be compliant with the requirements set forth for the Power Park Modules situated onshore.					Onshore and Offshore requirements are treated under the same general requirements in the GB Grid Code, for example CC.6.3.2 which covers reactive capability will cover both onshore and offshore requirements.	Scope statement in all documents where the requirements are placed e.g. G-Code, D-Code, Engineering Recommendations		Query over connection point definition and to what this applies.	
2. While respecting the provisions of Article 4(3), the Offshore Connection Point of an Offshore Power Park Module shall be defined by the Relevant Network Operator.						Process: D-Code / Grid Code Output: D-Code / Grid-Code			
3. Offshore Power Park Modules within the scope of this Network Code shall be categorized in accordance to the following Offshore Grid Connection System configurations:						Scope statement in all documents where the requirements are placed e.g. G-Code, D-Code, Engineering Recommendations			
(a) Configuration 1: AC connection to single onshore point such that one or more Offshore Power Park Modules are interconnected offshore to form an Offshore AC System and the Offshore AC System is connected to the Onshore System with one or more AC connection(s) to the same Onshore Grid Interconnection Point.									
(b) Configuration 2: Meshed AC connections such that a number of Offshore Power Park Modules are interconnected offshore to form an Offshore AC System and the Offshore AC System is connected to the Onshore System at two or more Onshore Grid Interconnection Point locations.									

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
Article 19									
Frequency stability requirements applicable to offshore power park modules									
The Frequency stability requirements defined respectively in Article 8(1) (a), (b), (c), (d) and (e), Article 10(2) and Article 16(2) (a) shall apply to any Offshore Power Park Module.						Scope statement in all documents where the requirements are placed e.g. G-Code, D-Code, Engineering Recommendations			
Article 20									
Voltage stability requirements applicable to offshore power park modules									
1. While still respecting the provisions according to Articles 9(3) (a) and 11(3) (a), a Offshore Power Park Module shall be capable of staying connected to the Network and operating within the ranges of the Network Voltage at the Connection Point, expressed by the Voltage at the Connection Point related to nominal Voltage (per unit), and within the time periods specified by table 10.					CC.6.1.4	Scope statement in all documents where the requirements are placed e.g. G-Code, D-Code, Engineering Recommendations			

Synchronous Area	Voltage Range
Continental Europe	0.85 pu – 0.90 pu
	0.9 pu – 1.118 pu*
	1.118 pu – 1.15 pu*
	0.90 pu – 1.05 pu**
	1. 05 pu – 1.10 pu**
Nordic	0.90 pu – 1.05 pu
	1.05 pu – 1.10 pu
Great Britain	0.90 pu – 1.10 pu*
	0.90 pu – 1.05 pu**
	1.05 pu – 1.10 pu**
Ireland	0.90 pu – 1.10 pu
Baltic	0.85 pu – 0.90 pu*
	0.90 pu – 1.12 pu*
	1.12 pu – 1.15 pu*
	0.88 pu – 0.90 pu**
	0.90 pu – 1.10 pu**
	1.10 pu – 1.15 pu**

* The Voltage base for pu values is below 300 kV.

** The Voltage base for pu values is from 300 kV to 400 kV.

Table 10: This table shows the minimum period an Offshore Power Park Module shall be capable of operating for different Voltage ranges deviating from a nominal value without disconnecting.

2. The Voltage stability requirements defined respectively in Article 15(2) (b) and (c) as well as in Article 16(3) (a), (c), (d), (e) and (f) shall apply to any Offshore Power Park Module.						Grid-Code / D-Code			

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
3. The Reactive Power capability at Maximum Capacity as defined in Article 16(3) (b) shall apply to Offshore Power Park Modules, except for table 9, which shall be replaced by table 11.					CC.6.3.2(e)	Grid-Code / D-Code			

Synchronous Area	Maximum Range of Q/P_{max}	Maximum range of steady-state Voltage level in PU
Continental Europe	0.75	0.225
Nordic	0.95	0.150
Great Britain	0* 0.33**	0.100
Ireland	0.66	0.218
Baltic States	0.8	0.22

*) at the Offshore Connection Point for configuration 1

**) at the Offshore Connection Point for configuration 2

Table 11: Parameters for figure 8									
Article 21									
Robustness requirements applicable to offshore power park modules									
1. The robustness of Power Generating Modules requirements as defined in Article 10(4) (a) and (b), and Article 15 (3) shall apply to Offshore Power Park Modules.						Scope statement in all documents where the requirements are placed e.g. G-Code, D-Code, Engineering Recommendations			
2. The fault-ride-through capability requirements as defined in Articles 9(3) (a) and 11(3) (a) shall apply to Offshore Power Park Modules.					CC.6.3.15.1 or CC.6.3.15.2	Grid-Code / D-Code			
Article 22									
System restoration requirements applicable to offshore power park modules									
The system restoration requirements defined respectively in Articles 9(4) and 10(5) shall apply to Offshore Power Park Modules.						Scope statement in all documents where the requirements are placed e.g. G-Code, D-Code, Engineering Recommendations			
Article 23									
General system management requirements applicable to offshore power park modules									
The general system management requirements defined in Articles 9(5), 10(6) and 11(4) shall apply to any Offshore Power Park Module.						Scope statement in all documents where the requirements are placed e.g. G-Code, D-Code, Engineering Recommendations			

CMWG have completed their mapping up until this point.

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
Chapter 1									
OPERATIONAL NOTIFICATION PROCEDURE FOR CONNECTION OF NEW POWER GENERATING MODULES									
Article 24									
GENERAL PROVISIONS									
1. The Power Generating Facility Owner shall demonstrate to the Relevant Network Operator its compliance with the requirements referred to in Title 2 of this Network Code by completing successfully the operational notification procedure for connection of each Power Generating Module as defined in Articles 25 to 32.					CP1				
2. Further details of the operational notification procedure shall be defined and made publicly available by the Relevant Network Operator while respecting the provisions of Article 4(3).									
Article 25									
Operation notification of Type A Power Generating Modules									
1. The operational notification procedure for connection of each new Type A Power Generating Module shall consist of an Installation Document. Based on an Installation Document obtained from the Relevant Network Operator, the Power Generating Facility Owner shall fill in the required information and submit it to the Relevant Network Operator. For subsequent Power Generating Modules separate independent Installation Documents shall be provided.									
The Relevant Network Operator shall ensure the possibility of the submission of the required information by third parties including aggregators.									
2. The content of the Installation Document shall be defined by the Relevant Network Operator while respecting the provisions of Article 4(3), at least containing the following:									
– the location at which the connection is made;									
– the date of the connection;									
– the Maximum Capacity of the installation in kW;									
– the type of primary energy source;									
– the classification of the Power Generating Module as an emerging technology according to Title 6 of this Network Code;									
– reference to Equipment Certificates used in the site installation;									
– for equipment used, which has not received an Equipment Certificate, information shall be provided as directed by the Relevant Network Operator; and									
– the contact details of the Power Generating Facility Owner and the installer and their signatures.									
3. On permanent decommissioning of a Power Generating Module the Power Generating Facility Owner shall notify the Relevant Network Operator.									
The Relevant Network Operator shall ensure the possibility of the submission of the required information by third parties including aggregators.									

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
4. The Relevant Network Operator shall ensure the possibility of electronic notification of operation and decommissioning of power generating modules.									
Article 26									
Operation notification of Type B, C and D Power Generating Modules									
The operational notification procedure for connection of each new Type B, C and D Power Generating Module shall allow the use of Equipment Certificates.									
Article 27									
Operational notification of Type B and C Power Generating Modules									
1. The operational notification procedure for connection of each new Type B and C Power Generating Module shall comprise a Power Generating Module Document (PGMD). The PGMD shall be provided by the Power Generating Facility Owner to the Relevant Network Operator and shall include a Statement of Compliance.					CP.6.3 – Data to be submitted in accordance with the User Data File Structure which includes the Compliance Statement and front sheet.				
For subsequent Power Generating Modules separate independent PGMDs shall be provided.									
2. The format of the PGMD and the information to be provided therein shall be defined by the Relevant Network Operator while respecting the provisions of Article 4 (3). Its content shall comprise the information defined in Articles 28 to 32 for Type D Power Generating Modules, which may be simplified through delivery in a single stage of operational notification as well as reduced requirements of details.									
3. The Relevant Network Operator on acceptance of a complete and adequate PGMD shall issue a Final Operational Notification to the Power Generating Facility Owner.									
4. On permanent decommissioning of a Power Generating Module the Power Generating Facility Owner shall notify the Relevant Network Operator in writing.									
5. The Relevant Network Operator shall ensure the possibility of electronic notification of operation and decommissioning of power generating modules.									
Article 28									
Operational notification of Type D Power Generating Modules									
The operational notification procedure for connection for each new Type D Power Generating Module shall comprise:					Energisation Operational Notification, Interim Operational Notification and Final Operational Notification are covered under CP.1.1 and in more detail under CP.5 CP.6 and CP.7				
– Energisation Operational Notification (EON);									
– Interim Operational Notification (ION);and									
– Final Operational Notification (FON).									

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
Article 29									
Energisation Operational Notification (EON) for Type D Power Generating Modules									
1. An Energisation Operational Notification (EON) shall entitle the Power Generating Facility Owner to energise its internal Network and auxiliaries for the Power Generating Modules by using the grid connection that is defined by the Connection Point.					CP.5				
2. An Energisation Operational Notification (EON) shall be issued by the Relevant Network Operator, subject to completion of preparation including agreement on the protection and control settings relevant to the Connection Point between the Relevant Network Operator and the Power Generating Facility Owner.									
Article 30									
Interim Operational Notification (ION) for Type D Power Generating Modules									
1. An Interim Operational Notification (ION) shall entitle the Power Generating Facility Owner to operate the Power Generating Module and generate power by using the grid connection for a limited period of time.					CP.6				
2. An Interim Operational Notification (ION) shall be issued by the Relevant Network Operator, subject to the completion of data and study review process as required by this Network Code.									
3. With respect to data and study review the Relevant Network Operator shall have the right to request the following from the Power Generating Facility Owner:									
(a) itemized Statement of Compliance;									
(b) detailed technical data of the Power Generating Module with relevance to the grid connection as specified by the Relevant Network Operator;									
(c) Equipment Certificates of Power Generating Module, where these are relied upon as part of the evidence of compliance;									
(d) simulation models as specified by Article 10(6) (c) and as required by the Relevant Network Operator while respecting the provisions of Article 4(3);									
(e) studies demonstrating expected steady-state and dynamic performance as required by Title 4 Chapters 5, 6 or 7 of this Network Code; and									
(f) details of intended compliance tests according to Title 4 Chapters 2, 3 and 4.									

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
4. The maximum period for the Power Generating Facility Owner to remain in the Interim Operational Notification (ION) status shall not exceed twenty-four months. The Relevant Network Operator is entitled to specify a shorter ION validity period while respecting the provisions of Article 4(2). The ION validity period shall be subject to notification to the National Regulatory Authority. The modalities of that notification shall be determined in accordance with the applicable national regulatory framework. ION extensions shall be granted only if the Power Generating Facility Owner has made substantial progress towards full compliance. At the time of ION extension, the outstanding issues should be explicitly identified.									
5. A prolongation of the maximum period for the Power Generating Facility Owner to remain in the Interim Operational Notification (ION) status (beyond a total of twenty-four months) may be granted upon request for derogation made to the Relevant Network Operator before the expiry of that period in accordance with the derogation procedure defined in the Code.									
Article 31									
Final Operational Notification (FON) for Type D Power Generating Modules									
1. A Final Operational Notification (FON) shall entitle the Power Generating Facility Owner to operate the Power Generating Module by using the grid connection.					CP.7				
2. A Final Operational Notification (FON) shall be issued by the Relevant Network Operator, upon prior removal of all incompatibilities identified for the purpose of the Interim Operational Notification (ION) status and subject to the completion of data and study review process as required by this Network Code.									
3. With respect to data and study review the following must be submitted to the Relevant Network Operator by the Power Generating Facility Owner:									
– itemized Statement of Compliance; and									
– update of applicable technical data, simulation models and studies as referred to in Article 30(3) (b), (c), (d) and (e), including use of actual measured values during testing.									
4. In case of incompatibility identified for the purpose of the granting of the Final Operational Notification (FON), a derogation may be granted upon request made to the Relevant Network Operator, in accordance with the derogation procedure according to Title 5. A Final Operational Notification (FON) shall be issued by the Relevant Network Operator, if the Power Generating Module is compliant with the provisions of the derogation. The Relevant Network Operator shall have the right to refuse the operation of the Power Generating Module, whose owner's request for derogation was rejected, until the Power Generating Facility Owner and the Relevant Network Operator have established a resolution of the incompatibility and the Power Generating Module is considered to be compliant by the Relevant Network Operator.									

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
Article 32									
Limited Operational Notification (LON) for Type D Power Generating Modules									
1. Power Generating Facility Owners to whom a Final Operational Notification (FON) has been granted shall inform the Relevant Network Operator immediately in the following circumstances:					CP.8				
(a) it is temporarily subject to either a significant modification or loss of capability, due to implementation of one or more modifications of significance to its performance; or									
(b) in case of equipment failures leading to non compliance with some relevant requirements.									
2. The Power Generating Facility Owner shall apply to the Relevant Network Operator for a Limited Operational Notification (LON), if the Power Generating Facility Owner reasonably expects the circumstances according to Article 32(1) to persist for more than three months.									
3. A Limited Operational Notification (LON) shall be issued by the Relevant Network Operator with a clear identification of:									
(a) the unresolved issues justifying the granting of the Limited Operational Notification (LON);									
(b) the responsibilities and timescales for the expected solution; and									
(c) a maximum period of validity which shall not exceed twelve months. The initial period granted may be shorter, with possibility for extension, if evidence to the satisfaction of the Relevant Network Operator has been made, which demonstrates that substantial progress has been made in terms of achieving full compliance.									
4. The Final Operational Notification (FON) shall be suspended during the period of validity of the Limited Operational Notification (LON) with regard to the subjects for which the Limited Operational Notification (LON) has been issued.									
5. A further prolongation of the period of validity of the Limited Operational Notification (LON) may be granted upon request for derogation made to the Relevant Network Operator, before the expiry of that period, in accordance with the derogation procedure according to Title 5.									
6. The Relevant Network Operator shall have the right to refuse the operation of the Power Generating Module, if the Limited Operational Notification (LON) terminates without removal of the circumstances which caused its issuing. In such a case the Final Operational Notification (FON) shall automatically be invalid.									

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
Chapter 2									
OPERATIONAL NOTIFICATION PROCEDURE FOR EXISTING POWER GENERATING MODULES									
Article 33									
Identification of costs and benefits of application of rules to Existing Power Generating Modules									
1. In order to assess the cost and benefits of the applicability of any requirement set forth in this Network Code to Existing Power Generating Modules, the Relevant TSO shall initiate the process referred to in Article 3(2) by a preparatory stage aimed at identifying cases of merit with the phases defined in Article 33(2) to (8) below.					Existing GB Compliance Provisions would be expected to apply to existing Power Stations. If future provisions are the same as the existing arrangements then opportunity should be taken to align the requirements.				
In the preparatory stage, the Relevant TSO shall undertake a qualitative comparison of costs and benefits related to the requirement under consideration for application to Existing Power Generating Modules. When undertaking the qualitative comparison of costs and benefits, the Relevant TSO shall take into account available network-based or market-based alternatives.									
The relevant TSO may only proceed to undertake a quantitative Cost-Benefit Analysis, as described in Paragraphs 2 to 5, if the qualitative comparison of costs and benefits indicates that the likely benefits exceed the likely costs. If however, the cost is deemed high and or the benefit is deemed low then the Relevant TSO may not proceed further.									
2. The TSO shall carry out a quantitative Cost-Benefit Analysis of a requirement under consideration for application to Existing Power Generating Modules that has demonstrated potential benefits as a result of the preparatory stage according to Paragraph 1 above. This Cost-Benefit Analysis shall be followed by a public consultation. The public consultation shall include, amongst others, a proposal for a transition period for applying a requirement to Existing Power Generating Modules. Such a transition period should not exceed two years from the decision of the National Regulatory Authority on the applicability.									
3. Power Generating Facility Owners, DSOs and CDSOs shall assist and contribute to this Cost-Benefit Analysis and provide the relevant data as requested by the Relevant TSO within three months after reception of the request, unless agreed otherwise.									
4. The Cost-Benefit Analysis shall be undertaken be undertaken in accordance with the following principles									
(a) The Relevant TSO shall be based on one or more of the following calculating principles:									
– net present value;									
– return on investment;									
– rate of return; and									
– time to break-even.									
(b) The Relevant TSO shall also quantify socio-economic benefits in terms of improvement of security of supply. This shall include at least :									
– associated reduction in probability of loss of supply over the lifetime of the modification;									
– the probable extent and duration of such loss of supply;									
– the societal cost per hour of such loss of supply;									

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(c) The Relevant TSO shall quantify as well as benefits to the internal market in electricity, cross-border trade and integration of renewable energies including, but not limited to:									
– Frequency response;									
– reserve holding;									
– Reactive Power provision;									
– congestion management; and									
– defence measures.									
(d) The Relevant TSO shall quantify the costs of applying the relevant rules to Existing Power Generating Modules, including but not limited to :									
– Direct costs for implementing the requirement;									
– The costs associated with attributable loss of opportunity;									
– The costs associated with resulting changes in maintenance and operating costs.									
5. The Relevant TSO shall summarise the analysis within three months in a report which shall include a recommendation on how to proceed.									
(a) This report shall be subject to public consultation.									
(b) Within 6 month of the end of the public consultation Relevant TSO shall prepare a report explaining the outcome of the consultation outcome and a proposal on the applicability of the requirement under consideration to Existing Power Generating Modules. This report shall be transmitted to the National Regulatory Authority.									
6. The proposal by the Relevant TSO to the National Regulatory Authority on applicability of any requirement of this Network Code according to Article 3(2) to Existing Power Generating Modules according to Title 1 Article 3(2) shall include the following:									
(a) an operational notification procedure in order to demonstrate the implementation of the requirements by the Power Generating Facility Owner;									
(b) an appropriate transition period for implementing the requirements. The determination of the transition period shall take into account the category of the Power Generating Module according to Article 3(6) (a) to (e) and any underlying obstacles for efficient undertaking of the equipment modification/refitting.									
7. The Relevant National Regulatory Authority shall decide on the case within three months of receipt of the report and the recommendation of the Relevant TSO.									
The decision of the National Regulatory Authority, if any, shall be published.									
All relevant clauses in contracts and/or relevant clauses in general terms and conditions relating to the grid connection of Existing Power Generating Modules shall be amended to achieve compliance with the requirements of this Network Code, that shall apply to them according to Article 33(6). The relevant clauses shall be amended within three years after the decision of the National Regulatory Authority on the applicability according to Article 3(2). This requirement for amendment shall apply regardless of whether the relevant contracts or general terms and conditions provide for such an amendment.									

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
Title 4									
COMPLIANCE									
Chapter 1									
COMPLIANCE MONITORING									
Article 34									
Responsibility of the Power Generating Facility Owner									
1. The Power Generating Facility Owner shall ensure that a Power Generating Module is compliant with the requirements under this Network Code. This compliance shall be maintained throughout the lifetime of the facility. For Type A power generating modules the Power Generating Facility Owner may rely upon equipment certificates.					CP.1, CP.2, CP.3 and CP.4				
2. Planned modifications of the technical capabilities of the Power Generating Module with possible impact on its compliance to the requirements under this Network Code shall be notified to the Relevant Network Operator by the Power Generating Facility Owner before initiating such modification.									
3. The Power Generating Facility Owner shall notify operational incidents or failures of a Power Generating Module that have impact on its compliance with the requirements of this Network Code to the Relevant Network Operator by without undue delay after the occurrence of such an incident.									
4. The Power Generating Facility Owner shall notify planned test schedules and procedures to verify compliance of a Power Generating Module with the requirements of this Network Code to the Relevant Network Operator in due time and prior to their launch. Those planned test schedules and procedures shall be approved in advance by the Relevant Network Operator.									
5. The Relevant Network Operator may participate in such tests and may record the performance of the Power Generating Modules.									
Article 35									
TASKS OF THE NETWORK OPERATOR									
1. The Relevant Network Operator shall regularly assess the compliance of a Power Generating Module with the requirements under this Network Code throughout the lifetime of the Power Generating Facility. The Power Generating Facility Owner shall be informed of the outcome of this assessment.					National Grid undertake all Compliance work for directly connected or Large Power Stations. The DNO is currently responsible for compliance of Small Embedded Power Stations and Licence Exempt Embedded Medium Power Stations.				
For type A power generating modules the Relevant Network Operator may rely upon equipment certificates in this assessment.									

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2. The Relevant Network Operator shall have the right to request the Power Generating Facility Owner to carry out compliance tests and according to a plan or general scheme for repeated tests and simulations defined while respecting the provisions of Article 4(3).									
The Relevant Network Operator shall have the right to request the Power Generating Facility Owner to carry out compliance tests after any failure, modification or replacement of any equipment that may have impact on the Power Generating Module's compliance with the requirements under this Network Code.									
The Power Generating Facility Owner shall be informed of the outcome of these compliance tests and simulations.									
3. The Relevant Network Operator shall make publicly available the list of information and documents to be provided as well as the requirements to be fulfilled by the Power Generating Facility Owner in the frame of the compliance process. Such list shall, notably, cover the following information, documents and requirements:									
– all documentation and certificates to be provided by the Power Generating Facility Owner;									
– details of the technical data of the Power Generating Module with relevance to the grid connection;									
– requirements for models for steady-state and dynamic system studies;									
– timely provision of system data required to perform the studies;									
– studies by the Power Generating Facility Owner for demonstrating expected steady-state and dynamic performance referring to the requirements set forth in Title 4 Chapter 4 and 5 of this Network Code; and									
– conditions and procedures including the scope for registering Equipment Certificates.									
– conditions and procedures for use of relevant Equipment Certificates by the Power Generating Facility Owner instead of part of the activity for compliance as described in this Network Code.									
4. The Relevant Network Operator shall make publicly available the allocation of responsibilities to the Power Generating Facility Owner and to the Network Operator for compliance testing, simulation and monitoring.									
5. The Relevant Network Operator may partially or totally assign the performance of its compliance monitoring to third parties. In this case, the Relevant Network Operator shall continue to ensure compliance with Article 6 of this Network Code, including by entering into appropriate confidentiality commitments with the assignee.									
6. The Relevant Network Operator shall not withhold unreasonably any operational notification in accordance with Title 3, if compliance tests or simulations cannot be performed as agreed between the Relevant Network Operator and the Power Generating Facility Owner for reasons which are responsibility of the Relevant Network Operator.									

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Article 36									
Common provisions for Compliance testing									
1. The testing of the performance of the individual Power Generating Modules within the Power Generating Facility shall aim at demonstrating the fulfilment of the requirements of this Network Code.					CC.6.6.2, OC5 In particular OC.5.5				
2. Notwithstanding the minimum requirements relating to the compliance testing laid down by the provisions of this Network Code, the Relevant Network Operator is, while respecting the provisions of Article 4 (3), entitled to:									
– allow the Power Generating Facility Owner to carry out an alternative set of tests, provided that those tests are efficient and sufficient to demonstrate compliance of a Power Generating Module to the requirements under this Network Code;									
– require the Power Generating Facility Owner to carry out an additional or alternative set of tests in case information supplied to the Relevant Network Operator by the Power Generating Facility Owner in relation to compliance testing under the provisions of Title 4 Chapter 2, 3 or 4 of this Network Code are not sufficient to demonstrate compliance to the requirements under this Network Code; and									
– 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 Network Operator and the Power Generating Facility Owner shall agree on which types of fuel are tested.									
3. The Power Generating Facility Owner is responsible for carrying out the tests in accordance with the conditions laid down in Title 4 Chapters 2, 3 and 4 of this Network Code. The Relevant Network Operator shall cooperate and not unduly delay the performance of the tests.									
4. The Power Generating Facility Owner is responsible for the safety of the personnel and the plant during the tests.									
5. The Relevant Network Operator may participate in the Compliance Testing either on site or remotely from the Network Operator's control centre. For that purpose, the Power Generating Facility Owner shall provide suitable monitoring equipment to record all relevant test signals and measurements as well as ensure that the relevant representatives from the Power Generating Facility Owner are available on site for the entire testing period. Signals specified by the Relevant Network Operator shall be provided, if the Relevant Network Operator wishes for selected tests to use own equipment to record the performance during tests.									
The decision as regards the participation of the Relevant Network Operator to the test and the form of this participation remains at the sole and exclusive discretion of the Relevant Network Operator.									
Article 37									
Common provisions on compliance simulation									
1. The simulation of the performance of the individual Power Generating Modules within the Power Generating Facility shall aim at demonstrating the fulfilment of the requirements of this Network Code.					CP - Appendix 3				

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
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2. Notwithstanding the minimum requirements relating to the Compliance Simulations laid down by the provisions of this Network Code, the Relevant Network Operator, while respecting the provisions of Article 4(3), may:									
(a) allow the Power Generating Facility Owner to carry out an alternative set of simulations, provided that those simulations are efficient and sufficient to demonstrate compliance of a Power Generating Module to the requirements under this Network Code or national legislation including national codes; and									
(b) require the Power Generating Facility Owner to carry out an additional or alternative set of simulations in case information supplied to the Relevant Network Operator by the Power Generating Facility Owner in relation to Compliance Simulation under the provisions of Title 4 Chapter 5, 6 or 7 of this Network Code are not sufficient to demonstrate compliance to the requirements under this Network Code.									
3. The Power Generating Facility Owner shall provide simulation results relevant to each and any individual Power Generating Module within the Power Generating Facility in a report form in order to demonstrate the fulfilment of the requirements of this Network Code. The Power Generating Facility Owner shall produce and provide a validated simulation model for a Power Generating Module. The coverage of the simulation models are described in Article 10(6) (c).									
4. The Relevant Network Operator shall have the right to check the compliance of a Power Generating Module with the requirements of this Network Code by carrying out its own Compliance Simulations based on the provided simulation reports, simulation models and compliance test measurements.									
5. The Relevant Network Operator shall provide to the Power Generating Facility Owner the technical data and the simulation model of the Network, in the extent necessary for carrying out the requested simulations according to Title 4 Chapter 5, 6 or 7 of this Network Code.									
Chapter 2									
COMPLIANCE TESTING FOR SYNCHRONOUS POWER GENERATING MODULES									
Article 38									
Compliance tests for Type B synchronous power generating modules									
1. Power Generating Facility Owners shall undertake LFSM-O response test compliance tests in relation to Type B Synchronous Power Generating Modules.									
An Equipment Certificate may be used instead of part or all of the tests in that case the Equipment Certificate shall be provided to the Relevant Network Operator.									
2. With regard to the LFSM-O response test:									

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(c) The Power Generating Module shall demonstrate its technical capability to continuously modulate Active Power to contribute to Frequency Control in case of large increase of Frequency in the system and shall verify the steady-state parameters of regulations, such as Droop and deadband, and dynamic parameters, including Frequency step change response.									
(d) The test shall be carried out by simulating Frequency steps and ramps big enough to activate at least 10 % of Maximum Capacity change in Active Power, taking into account the Droop settings and the deadband. Simulated Frequency deviation signals shall be injected simultaneously at both the speed and power control loops of the control systems if required, taking in account the scheme of these control system.									
(e) The test shall be deemed passed if the following conditions are both fulfilled:									
(1) the test results, for both dynamic and static parameters, meet the requirements as referred to in Article 8(1) (c); and									
(2) undamped oscillations do not occur after the step change response.									
Article 39									
Compliance tests for Type C synchronous power generating modules									
MODULES									
1. In addition to the compliance tests for Type B Synchronous Power Generating Modules in the conditions as referred to in Article 38, Power Generating Facility Owners shall undertake to the compliance tests set out in paragraphs 2, 3, 4 and 6 in relation to Type C Synchronous Power Generating Modules.					OC5 – Appendix 2 – Note all the tests completed under Article 39 are not necessarily the same as those under OC5 Appendix 2. For example Black Start tests are completed via a separate Black Start Contract and the GB Grid Code does not have a requirement for LFSM-U. The full tests in GB cover more than those listed in Article 39 eg Excitation tests and Power System Stabiliser Tests.				
Where the Power generating Module provides Black Start Capability, Power Generating Facility Owners shall also undertake the Tests in Paragraph 5.									
An Equipment Certificate may be used instead of part or all of the tests, in that case the Equipment Certificate shall be provided to the Relevant Network Operator.									
2. With regard to the LFSM-U response test:									
(a) The Power Generating Module shall demonstrate its technical capability to continuously modulate Active Power at operating points below Maximum Capacity to contribute to Frequency Control in case of large drop of Frequency in the system.									
(b) The test shall be carried out by simulating at appropriate Active Power load points (e.g. 80 %) with low Frequency steps and ramps big enough to activate at least 10 % of Maximum Capacity Active Power change, taking into account the Droop settings and the deadband. Simulated Frequency deviation signals shall be injected simultaneously into both the speed governor and the load controller references if required, taking into account the speed governor and the load controller scheme.									
(c) The test is deemed passed, provided that the following conditions are both fulfilled:									

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(1) the test results, for both dynamic and static parameters, are in line with the requirements as referred to in Article 10(2) (b); and									
(2) undamped oscillations do not occur after the step change response.									
3. With regard to the FSM response test:									
(a) The Power Generating Module shall demonstrate its technical capability to continuously modulate Active Power over the full operating range between Maximum Capacity and Minimum Regulating Level to contribute to Frequency Control and shall verify 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 changes.									
(b) The test shall be carried out by simulating Frequency steps and ramps big enough to activate the whole Active Power Frequency response range, taking into account the Droop settings, the deadband and the Real Power headroom or deload (margin to Maximum Capacity in operational timescale). 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 if required, taking into account the speed governor and load controller scheme.									
(c) The test shall be deemed to be passed if the following conditions are all fulfilled:									
(1) activation time of full Active Power Frequency response range as result of a step Frequency change has been no longer than required by Article 10(2) (c);									
(2) undamped oscillations do not occur after the step change response;									
(3) the initial delay time has been according to Article 10(2) (c);									
(4) the Droop settings are available within the range defined in Article 10(2) (c) and deadband (thresholds) is not more than the value in Article 10(2) (c); and									
(5) insensitivity of Active Power Frequency response at any relevant operating point does not exceed the requirements set forth in Article 10(2) (c).									
4. With regard to the frequency restoration control test:									
(a) The Power Generating Module shall demonstrate its technical capability to participate in Frequency restoration control. The cooperation of FSM and Frequency restoration control shall be checked.									
(b) The test is deemed passed, provided that the test results, for both dynamic and static parameters, are in line with the requirements as referred to in Article 10(2) (d).									
5. With regard to the Black Start Capability test:									
(a) Power Generating Modules with Black Start Capability in accordance with Article 10(5) (a), shall demonstrate this technical capability to start from shut down without any external energy supply.									

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(b) The test is deemed passed, provided that the start-up time has been not longer than the timeframe according to Article 10(5) (a) point 2).									
6. With regard to the tripping to houseload test:									
(a) Power Generating Modules shall demonstrate their technical capability to trip to and stably operate on house load.									
(b) The test shall be carried out at the Maximum Capacity and nominal Reactive Power of the Power Generating Module before load shedding.									
(c) Further conditions for this test shall be defined by the Relevant Network Operator while respecting the provisions of Article 4(3) taking into account Article 10(5) (c).									
(d) The test is deemed passed, provided that tripping to houseload has been successful and stable Houseload Operation has been demonstrated for time period according to Article 10(5) (c) and re-synchronisation to the Network has been performed successfully.									
7. With regard to the Reactive Power Capability test:									
(a) The Power Generating Module shall demonstrate its technical capability to provide leading and lagging Reactive Power capability according to Article 13(2) (b) and (c).									
(b) The test shall be deemed passed, if the following conditions are cumulatively fulfilled:									
(1) the Power Generating Module has been operating no shorter than 1 hour at maximum Reactive Power, both leading and lagging, for each of:									
– Minimum Stable Operating Level;									
– Maximum Capacity; and									
– an Active Power operating point between those maximum and minimum ranges;									
(2) The Power Generating Module demonstrates its capability to change to any Reactive Power target value within the agreed or decided Reactive Power range within the specified performance targets of the relevant Reactive Power control scheme.									
Article 40									
Compliance tests for Type D synchronous power generating modules									
Type D Synchronous Power Generating Modules are subject to the compliance tests for Type B and C Synchronous Power Generating Modules in the conditions as referred to in Articles 38 and 39.					As per Type C – See item 64 above. The principle of Equipment Certificates is not used in GB				
An Equipment Certificate may be used instead of part or all of the tests, in that case the Equipment Certificate shall be provided to the Relevant Network Operator.									

Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes					Changes to the GB Codes		ISSUE FLAGS	
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Chapter 3									
COMPLIANCE TESTING FOR POWER PARK MODULES									
Article 41									
Compliance tests for Type B power park modules									
1. Power Generating Facility Owners shall undertake LFSM-O response test compliance tests in relation to Type B Power Park Modules.									
An Equipment Certificate may be used instead of part or all of the tests, in that case the Equipment Certificate shall be provided to the Relevant Network Operator.									
2. With regard to Type B Power Park Modules the LFSM-O response tests shall be carried out reflecting the choice of control scheme selected by the Relevant Network Operator.									
(a) The Power Park Module shall demonstrate its technical capability to continuously modulate Active Power to contribute to Frequency Control in case of increase of Frequency in the system and shall verify the steady-state parameters of regulations, such as Droop and deadband, and dynamic parameters, including Frequency step change response.									
(b) The test shall be carried out by simulating Frequency steps and ramps big enough to activate at least 10 % of Maximum Capacity change in Active Power, taking into account the Droop settings and the deadband. Simulated Frequency deviation signals shall be injected to perform this test.									
(c) The test shall be deemed passed, provided that the test results, for both dynamic and static parameters, are in line with the requirements as referred to in Article 8(1) (c).									
Article 42									
Compliance tests for Type C power park modules									
1. In addition to the compliance tests for Type B Power Park Modules in the conditions as referred to in Article 41, Power generation facility owners shall undertake the compliance tests set out in Paragraphs 2-9 in relation to Type C Power Park Modules					OC5 – Appendix 3 – The GB Grid Code does not have a requirement for LFSM-U. No Power Factor Control Tests are undertaken. Power Park Modules are required to operate in Voltage Control Mode. *Tests are different durations and levels from GB*				
An Equipment Certificate may be used instead of part or all of the tests, in that case the Equipment Certificate shall be provided to the Relevant Network Operator.									
2. With regard to the Active Power controllability and control range test:									
(a) The Power Park Module shall demonstrate its technical capability to operate at a load level no higher than the Setpoint set by the Relevant Network Operator or the Relevant TSO.									
(b) The test shall be deemed passed if that the following conditions are cumulatively fulfilled:									
(1) the load level of the Power Park Module is kept below the Setpoint;									
(2) the Setpoint is implemented according to the requirements as referred to in Article 10(2) (a); and									

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(3) the accuracy of the regulation is compliant with specified value according to Article 10(2) (a).									
3. With regard to the LFSM-U response test:									
(a) The Power Park Module shall demonstrate its technical capability to continuously modulate Active Power to contribute to Frequency Control in case of large drop of Frequency in the system.									
(b) The test shall be carried out by simulating the Frequency steps and ramps big enough to activate 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. Simulated Frequency deviation signals shall be injected in the Power Park Module controller scheme, taking into account both speed governor and load controller scheme, if applicable.									
(c) The test shall be deemed passed if the following conditions are cumulatively fulfilled:									
(1) the test results, for both dynamic and static parameters, are in line with the requirements as referred to in Article 10(2) (b); and									
(2) undamped oscillations after the step change response does not occur.									
4. With regard to the FSM response test:									
(a) The Power Park Module shall demonstrate its technical capability to continuously modulate Active Power over the full operating range between Maximum Capacity and Minimum Regulating Level to contribute to Frequency Control and shall verify 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.									
(b) The test shall be carried out by simulating Frequency steps and ramps big enough to activate whole Active Power Frequency response range, taking into account the Droop settings and the deadband. Simulated Frequency deviation signals shall be injected to perform this test.									
(c) The test shall be deemed passed if the following conditions are cumulatively fulfilled:									
(1) the activation time of full Active Power Frequency response range as result of a step Frequency change has been no longer than that required by Article 10(2) (c);									
(2) undamped oscillations do not occur after the step change response;									
(3) the initial delay has been according to Article 10(2) (c);									
(4) the Droop settings are available within the ranges defined in Article 10(2) (c) and deadband (thresholds) is not more than the value chosen by the TSO; and									
(5) the insensitivity of Active Power Frequency response does not exceed the requirement according to Article 10(2) (c).									
5. With regard to the frequency restoration control test:									

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(a) The Power Park Module shall demonstrate its technical capability to participate in Frequency restoration control. The cooperation of both FSM and Frequency restoration control shall be checked.									
(b) The test shall be deemed passed if the test results for both dynamic and static parameters are in line with the requirements as referred to in Article 10(2) (d).									
6. With regard to the Reactive Power capability test:									
(a) The Power Park Module shall demonstrate its technical capability to provide leading and lagging Reactive Power capability according to Article 16(3) (b) and (c).									
(b) The Reactive Power Capability test shall be carried out at maximum Reactive Power, both leading and lagging, and concerning the verification of the following parameters:									
(1) operation in excess of 60 % of Maximum Capacity for 30 min;									
(2) operation within the range of 30 – 50 % of Maximum Capacity for 30 min; and									
(3) operation within the range of 10 – 20 % of Maximum Capacity for 60 min.									
(c) The test shall be deemed passed if the following criteria are cumulatively fulfilled:									
(1) the Power Park Module has been operating no shorter than requested duration at maximum Reactive Power, both leading and lagging, in each parameter as referred to in Article 42(6) (b);									
(2) the Power Park Module has demonstrated its capability to change to any Reactive Power target value within the agreed or decided Reactive Power range within the specified performance targets of the relevant Reactive Power control scheme; and									
(3) no action of any protection within the operation limits defined by Reactive Power capacity diagram occurs.									
7. With regard to the Voltage Control Mode test:									
(a) The Power Park Module shall demonstrate its capability to operate in Voltage control mode in the conditions set forth in Article 16(3) (d) point 2).									
(b) The Voltage Control Mode test shall apply concerning the verification of the following parameters:									
(1) the implemented Slope and deadband of the static characteristic;									
(2) the accuracy of the regulation;									
(3) the insensitivity of the regulation; and									
(4) the time of Reactive Power activation.									
(c) The test shall be deemed passed if the following conditions are cumulatively fulfilled:									
(1) the implemented Slope and deadband of the static characteristic;									
(2) the range of regulation and adjustable the Droop and deadband is compliant with agreed or decided characteristic parameters, according to Article 16(3) (d);									

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	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
(3) the insensitivity of Voltage Control is not higher than 0.01 pu, according to Article 16(3) (d); and									
(4) following a step change in Voltage, 90 % of the change in Reactive Power output has been achieved within the times and tolerances according to Article 16(3) (d).									
8. With regard to the Reactive Power Control Mode test:									
(a) The Power Park Module shall demonstrate its capability to operate in Reactive Power control mode, according to the conditions referred to in Article 16(3) (d) point 3).									
(b) The Reactive Power Control Mode test shall be complementary to the Reactive Power Capability test.									
(c) The Reactive Power Control Mode test shall apply concerning the verification of the following parameters:									
(1) the Reactive Power Setpoint range and step;									
(2) the accuracy of the regulation; and									
(3) the time of Reactive Power activation.									
(d) The test shall be deemed passed if the following conditions are cumulatively fulfilled:									
(1) the Reactive Power Setpoint range and step is ensured according to Article 16(3) (d); and									
(2) the accuracy of the regulation is compliant with the conditions as referred to in Article 16(3) (d).									
9. With regard to the Power Factor Control Mode test:									
(a) The Power Park Module shall demonstrate its capability to operate in Power Factor control mode according to the conditions referred to in Article 16(3) (d) point 4).									
(b) The Power Factor Control Mode test shall apply concerning the verification of the following parameters:									
(1) the Power Factor Setpoint range;									
(2) the accuracy of the regulation; and									
(3) the response of Reactive Power due to step change of Active Power.									
a) The test shall be deemed passed if the following conditions are cumulatively fulfilled:									
(1) the Power Factor Setpoint range and step is ensured according to Article 16(3) (d);									
(2) the time of Reactive Power activation as result of step Active Power change does not exceed the requirement according to Article 16(3) (d); and									
(3) the accuracy of the regulation is compliant with the value, as referred to in Article 16(3) (d).									
10. With regard to the tests identified in paragraphs 7, 8 and 9 the Relevant Network Operator may select only one of the three control options for testing.									
Article 43									
Compliance tests for Type D power park modules									
Type D Power Park Modules are subject to the compliance tests for Type B and C Power Park Modules in the conditions as referred to in Articles 41 and 42.					As per Type C – See item 67 above. The				

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An Equipment Certificate may be used instead of part or all of the tests, in that case the Equipment Certificate shall be provided to the Relevant Network Operator.					principle of Equipment Certificates is not used in GB				
Chapter 4									
COMPLIANCE TESTING FOR OFFSHORE POWER PARK MODULES									
Article 44									
Compliance testing for offshore power park modules									
The compliance tests as defined in Article 41(2), as well as in Article 42(2), (3), (4), (5) and (7), (8) and (9) shall apply to any Offshore Power Park Module.					OC5 – Appendix 3 – specific requirements included for Offshore Power Park Modules.				
Chapter 5									
COMPLIANCE SIMULATIONS FOR SYNCHRONOUS POWER GENERATING MODULES									
Article 45									
Compliance simulations for Type B synchronous power generating modules									
1. Power Generating Facility Owners shall undertake LFSM-O response test compliance tests in relation to Type B Power Park Modules.					Type B Synchronous Power Generating Modules (1MW – 10MW) are not currently covered under the GB Grid Code although the simulations carried out for Type B plant would be applied to larger GB Plant under CP-Appendix 3.				
An Equipment Certificate may be used instead of part or all of the tests, in that case the Equipment Certificate shall be provided to the Relevant Network Operator.									
2. With regard to the LFSM-O response simulation:									
(a) The Power Generating Module shall demonstrate its capability to simulate Active Power modulation at high Frequency according to Article 8(1) b.									
(b) The simulation shall be carried out by simulating high Frequency steps and ramps reaching Minimum Regulating Level, taking into account the Droop settings and the deadband.									
(c) The simulation is deemed passed, provided that:									

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	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem)
(1) the simulation model of the Power Generating Module is validated against the compliance test for LFSM-O response as referred to in Article 38(2); and									
(2) compliance with the requirement according to Article 8(1) (c) is demonstrated.									
3. With regard to the Type B fault-ride-through capability of Synchronous Power Generating Modules simulation:									
(a) The Power Generating Module shall demonstrate its capability to simulate fault-ride-through capability in the conditions set forth in Article 9(3) (a).									
(b) The simulation is deemed passed, provided that compliance with the requirement according to Article 9(3) (a) is demonstrated.									
4. With regard to the Post Fault Power Active Recovery simulation:									
(a) The Power Generating Module shall demonstrate its capability to simulate post fault Active Power recovery in the conditions set forth in Article 12(3) (a).									
(b) The simulation is deemed passed, provided that compliance with the requirement according to Article 12(3) (a) is demonstrated.									
Article 46									
COMPLIANCE SIMULATIONS FOR TYPE C SYNCHRONOUS POWER GENERATING MODULES									
1. In addition to the Compliance Simulations for Type B Synchronous Power Generating Modules in the conditions as referred to in Article 45, Type C Synchronous Power Generating Modules are subject to the following Compliance Simulations. The Equipment Certificate may be used instead of part or all of the simulations below, provided that they are provided to the Relevant Network Operator.					CP – Appendix 3. LFSM-U is not a requirement of the GB Code.				
2. With regard to the LFSM-U response simulation:									
(a) The Power Generating Module shall demonstrate its capability to simulate Active Power modulation at low Frequencies according to Article 10(2) b.									
(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 is deemed passed, provided that:									
(1) the simulation model of the Power Generating Module is validated against the compliance test for LFSM-U response as referred to in Article 39(2); and									
(2) compliance with the requirement according to Article 10(2) (b) is demonstrated.									
3. With regard to the FSM response simulation:									
(a) The Power Generating Module shall demonstrate its capability to modulate Active Power over the full Frequency range according to Article 10(2) (c).									
(b) The simulation shall be carried out by simulating Frequency steps and ramps big enough to activate whole Active Power Frequency response range, taking into account the Droop settings and the deadband.									

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(c) The simulation is deemed passed, provided that:									
(1) the simulation model of the Power Generating Module is validated against the compliance test for LFSM-U response as referred to in Article 39(3); and									
(2) compliance with the requirement according to Article 10(2) (c) is demonstrated.									
4. With regard to the Island Operation simulation:									
(a) The Power Generating Module shall demonstrate its performance during Island Operation in the conditions as referred to in Article 10(5) (b).									
(b) The simulation is deemed passed, provided that 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 Article 10(5) (b) without disconnection of the Power Generating Module from the island due to over-/underfrequency; and									
5. With regard to the Reactive Power Capability simulation:									
(a) The Power Generating Module shall demonstrate its capability to simulate leading and lagging Reactive Power capability in the conditions referred to in Article 13(2) (b) and (c).									
(b) The simulation is deemed passed, provided that the following conditions are cumulatively fulfilled:									
(1) the simulation model of the Power Generating Module is validated against the compliance tests for Reactive Power Capability at the as referred to in Article 39(7); and									
(2) compliance with the requirements as referred to in Article 13(2) (b) and (c) is demonstrated.									
Article 47									
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 in the conditions as referred to in Articles 46 and 47, except for the Type B fault-ride-through capability of Synchronous Power Generating Modules as referred to in Article 45(4), Type D Synchronous Power Generating Modules are subject to the following Compliance Simulations. The Equipment Certificate may be used instead of part or all of the simulations below, provided that they are provided to the Relevant Network Operator.					CP – Appendix 3				
2. With regard to the Power Oscillations Damping Control simulation:									
(a) The Power Generating Module shall demonstrate the performance of its control system (PSS function) to damp power oscillations in the conditions set forth in Article 14(2) (g).									
(b) The tuning shall 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 is deemed passed, provided that the following conditions are cumulatively fulfilled:									

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(1) the PSS function damps the existing power oscillations of the Power Generating Module within a Frequency range specified by the Relevant TSO. This Frequency range shall include the local mode frequency of the Power Generating Module and the expected Network oscillations; and									
(2) a sudden load reduction of the Power Generating Module from 1p.u. to 0.6p.u. of the Maximum Capacity has not lead to undamped oscillations in Active or Reactive Power of the Power Generating Module.									
3. With regard to the Type D fault-ride-through capability of Synchronous Power Generating Modules simulation:									
(a) The Power Generating Module shall demonstrate its capability to simulate fault-ride-through capability in the conditions set forth in Article 11(3) (a).									
(b) The simulation is deemed passed, provided that compliance with the requirement according to Article 11(3) (a) is demonstrated.									
Chapter 6									
COMPLIANCE SIMULATIONS FOR POWER PARK MODULES									
Article 48									
COMPLIANCE SIMULATIONS FOR TYPE B POWER PARK MODULES									
1. Type B Power Park Modules are subject to the following compliance simulations. The Equipment Certificate may be used instead of part or all of the simulations below, provided that they are provided to the Relevant Network Operator.									
2. With regard to the LFSM-O response simulation:									
(a) The Power Park Module shall demonstrate its capability to simulate Active Power modulation at high Frequency according to Article 8(1) b.									
(b) The simulation shall be carried out by simulating high Frequency steps and ramps reaching Minimum Regulating Level, taking into account the Droop settings and the deadband.									
(c) The simulation is deemed passed, provided that:									
(1) the simulation model of the Power Park Module is validated against the compliance test for LFSM-O response as referred to in Article 41(2); and									
(2) compliance with the requirement according to Article 8(1) (c) is demonstrated.									
3. With regard to the fast acting additional reactive Current injection simulation:									
(a) The Power Generating Module shall demonstrate its capability to simulate fast acting additional reactive Current injection in the conditions set forth in Article 15(2) (b).									
(b) The simulation is deemed passed, provided that compliance with the requirement according to Article 15(2) (b) is demonstrated.									

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4. With regard to the Type B fault-ride-through capability of Power Park Modules simulation:									
(c) The Power Generating Module shall demonstrate its capability to simulate fault-ride-through capability in the conditions set forth in Article 9(3) (a).									
(d) The simulation is deemed passed, provided that compliance with the requirement according to Article 9(3) (a) is demonstrated.									
5. With regard to the Post Fault Power Active Recovery simulation:									
(a) The Power Generating Module shall demonstrate its capability to simulate post fault Active Power recovery in the conditions set forth in Article 15(3) (a).									
(b) The simulation is deemed passed, provided that compliance with the requirement according to Article 15(3) (a) is demonstrated.									
Article 49									
COMPLIANCE SIMULATIONS FOR TYPE C POWER PARK MODULES									
1. In addition to the Compliance Simulations for Type B Power Park Modules in the conditions as referred to in Article 48, Type C Power Park Modules are subject to the following Compliance Simulations. The Equipment Certificate may be used instead of part or all of the simulations below, provided that they are provided to the Relevant Network Operator.					CP – Appendix 3. LFSM-U is not a requirement of the GB Code. Fast current injection would be assessed as part of the Fault Ride Through requirements under CP.A.3.5. Synthetic inertia and power oscillation damping are not assessed.				
2. With regard to the LFSM-U response simulation:									
(c) The Power Park Module shall demonstrate its capability to simulate Active Power modulation at low Frequencies according to Article 10(2) b.									
(d) 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.									
(e) The simulation is deemed passed, provided that:									
1) the simulation model of the Power Park Module is validated against the compliance test for LFSM-U response as referred to in Article 42(3); and									
2) compliance with the requirement according to Article 10(2) (b) is demonstrated.									
3. With regard to the FSM response simulation:									
(a) The Power Park Module shall demonstrate its capability to modulate Active Power over the full Frequency range according to Article 10(2) (c).									

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(b) The simulation shall be carried out by simulating Frequency steps and ramps big enough to activate whole Active Power Frequency response range, taking into account the Droop settings and the deadband.									
(c) The simulation is deemed passed, provided that:									
(1) the simulation model of the Power Park Module is validated against the compliance test for LFSM-U response as referred to in Article 42(4); and									
(2) compliance with the requirement according to Article 10(2) (c) is demonstrated.									
4. With regard to the Island Operation simulation:									
(a) The Power Generating Module shall demonstrate its performance during Island Operation in the conditions as referred to in Article 10(5) (b).									
(b) The simulation is deemed passed, provided that 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 Article 10(5) (b) without disconnection of the Power Generating Module from the island due to over-/underfrequency; and									
5. With regard to the simulation of the capability of providing Synthetic Inertia:									
(a) The model of the Power Generating Module shall demonstrate its capability to simulate the capability of providing Synthetic Inertia to a low Frequency event in the conditions as referred to in Article 16(2) (a).									
(b) The simulation is deemed passed, provided that the model demonstrates compliance with the conditions of Article 16(2) (a).									
6. With regard to the Reactive Power capability simulation:									
(a) The Power Park Module shall demonstrate its capability to simulate leading and lagging Reactive Power capability in the conditions referred to in Article 16(3) (b) and (c).									
(b) The simulation is deemed passed, provided that the following conditions are cumulatively fulfilled:									
(1) the simulation model of the Power Park Module is validated against the compliance tests for Reactive Power Capability at the as referred to in Article 42(6); and									
(2) compliance with the requirements as referred to in Article 16(3) (b) and (c) is demonstrated.									
7. With regard to the power oscillations damping control simulation:									
(a) The model of the Power Generating Module shall demonstrate its capability to simulate power oscillations damping capability in the conditions as referred to in Article 16(3) (f).									
(b) The simulation is deemed passed, provided that the model demonstrates compliance with the conditions of Article 16(3) (f).									

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Article 50									
COMPLIANCE SIMULATIONS FOR TYPE D POWER PARK MODULES									
1. In addition to the Compliance Simulations for Type B and C Power Park Modules in the conditions as referred to in Articles 49 and 50, except for the Type B fault-ride-through capability of Power Park Modules as referred to in Article 48(4), Type D Power Park Modules are subject to the Type D fault-ride-through capability of Power Park Modules Compliance Simulation. The Equipment Certificate may be used instead of part or all of the simulations below, provided that they are provided to the Relevant Network Operator.									
2. The model of the Power Generating Module shall demonstrate its capability to simulate fault-ride-through capability in the conditions as referred to in Article 11(3) (a).									
3. The simulation is deemed passed, provided that the model demonstrates compliance with the conditions of Article 11(3) (a) respectively.									
Chapter 7									
COMPLIANCE SIMULATIONS FOR OFFSHORE POWER PARK MODULES									
Article 51									
COMPLIANCE SIMULATIONS APPLICABLE TO OFFSHORE POWER PARK MODULES									
The Compliance Simulations as defined in Article 48 (3) and (5) as well as in Article 49(4), (5) and (7) shall apply to any Offshore Power Park Module.									
Chapter 8									
NON BINDING GUIDANCE, MONITORING, ON IMPLEMENTATION AND STAKEHOLDER INVOLVEMENT									
Article 51 a									
NON BINDING GUIDANCE ON IMPLEMENTATION									
By [24 months after entry into force of this regulation] ENTSO-E shall prepare and thereafter regularly update non-binding guidance for its members and for other network operators on the elements of this regulation where national level decisions are required. This non-binding guidance shall explain the technical issues, conditions and interdependencies which need to be considered when determining requirements at national level.									
Article 51 b									
MONITORING BY ENTSO-E									
1. ENTSO-E shall monitor the implementation of this Network Code pursuant to Article 8(8) of Regulation (EC) No 714/2009, and in this regard shall in particular address whether divergent national implementation of this network code is leading to distortions in the internal electricity market and whether the choice of values and ranges in the requirements applicable to power generating modules in this network code continues to be valid.									

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2. A list with the relevant information to be communicated by ENTSO-E to the Agency pursuant to Article 8(9) of Regulation (EC) No 714/2009 shall be determined [within three months] after the entry into force of this Network Code by the Agency in close cooperation with ENTSO-E. This list of relevant information is without prejudice to the Agency's right to request from ENTSO-E other information required by the Agency to fulfil its tasks under Article 9(1) of Regulation (EC) No 714/2009. ENTSO-E shall maintain a comprehensive, standardized format, digital data archive of the information required by the Agency.									
Relevant Network Operators shall provide ENTSO-E with all relevant information to allow them to carry out their monitoring functions.									
Article 51 c									
STAKEHOLDER COMMITTEE									
1. ENTSO-E shall establish and regularly convene a stakeholder committee which shall represent the views of Stakeholders to ENTSO-E									
(a) In preparing the non-binding guidance referred to in Paragraph 1.									
(b) In undertaking the monitoring role referred to in the first subparagraph of Paragraph 2									
(c) Any other issue related to the implementation of this Regulation									
2. The stakeholder committee referred to in Paragraph 3 shall include a broad representation of distribution system operators, system users and power equipment manufacturers. The Agency and the Commission may attend meetings of the committee as observers.									
Prior to its first meeting and at least yearly thereafter, ENTSO-E shall submit to the Agency the proposed composition of the stakeholder committee. The Agency may issue an opinion on the composition of the committee. ENTSO-E shall take utmost account of such an opinion.									
ENTSO-E shall submit to the Agency proposed rules and procedures of the stakeholder committee. The Agency may provide an opinion on the proposed composition. ENTSO-E shall take utmost account of such an opinion.									
The stakeholder committee may be merged with other stakeholder committees established by ENTSO-E to assist it in performing its monitoring duties pursuant to Article 8(8) of Regulation (EC) No 714/2009.									

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Title 5									
DEROGATIONS									
Article 52									
GENERAL PROVISIONS									
1. The procedure for derogations defined in this Title applies to all Power Generating Facility Owners, both of Existing and New Power Generating Modules, to which the provisions of this Network Code are applicable pursuant to Article 3. Only the Power Generating Facility Owner shall have the right to apply for derogations for Power Generating Modules within its facility.					Not specifically covered in the Grid Code (other than under CP.9) but a Derogation Process does exist with the Regulator				
2. It shall apply as well to Network Operators when applying for derogations for classes of both existing and new Power Generating Modules connected to their Network.									
3. The derogation process shall be transparent, non-discriminatory, non-biased, well documented and based in particular on a Cost-Benefit Analysis performed pursuant to the standards set forth by Article 33(4) and (5), by the Relevant Network Operator in coordination with the Relevant TSO. Cost-Benefit Analysis does not need to be performed by the Relevant Network Operator if, on its reasoned request, an individual exemption is granted to the Relevant Network Operator by the National Regulatory Authority.									
4. Criteria for assessing the request for derogation shall be set by the relevant National Regulatory Authority taking into account recommendation of the Relevant Network Operator in coordination with the Relevant TSO. The criteria set by the Relevant National Regulatory Authority shall be non-discriminatory, objective and shall be published by the National Regulatory Authority.									
Article 53									
REQUEST FOR DEROGATION									
1. Power Generating Facility Owners may apply for derogation in respect of one or more requirements of this Network Code by submitting a request to the Relevant Network Operator.					Not specifically covered in the Grid Code (other than under CP.9) but a Derogation Process does exist with the Regulator				
2. The request for derogation, submitted by the Power Generating Facility Owner shall include all the information and documents which are required by the Relevant Network Operator in coordination with the Relevant TSO, including, inter alia, but not limited to:									
(a) identifying data of the Power Generating Facility Owner, with reference contact person for any communications;									
(b) the specific Power Generating Module to which the request is referred to;									
(c) the provision of the Network Code for which a derogation is requested, with the detailed description of the requested derogation;									

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(d) detailed reasoning accompanied with all relevant documents supporting the request.									
3. A DSO or CDSO may apply for derogation in respect of one or more requirements of this Network Code by submitting a request to the Relevant TSO.									
4. The request for derogation, submitted by the DSO or CDSO shall include all the information and documents which are required by the Relevant TSO, including, inter alia, but not limited to:									
(a) identifying data of the DSO or CDSO, with reference contact person for any communications;									
(b) the number of Power Generating Modules affected and the total installed capacity to which the request is referred to;									
(c) the provision of the Network Code for which a derogation is requested, with the detailed description of the requested derogation;									
(d) detailed reasoning accompanied with all relevant documents supporting the request.									
5. A TSO may apply for derogation in respect of one or more requirements of this Network Code by submitting a request to the National Regulatory Authority.									
6. The request for derogation, submitted by the TSO shall include the following information:									
(a) identifying data of the TSO, with reference contact person for any communications;									
(b) the number of Power Generating Modules affected and the total installed capacity to which the request is referred to;									
(c) the provision of the Network Code for which a derogation is requested, with the detailed description of the requested derogation;									
(d) detailed reasoning accompanied with all relevant documents supporting the request.									
Article 54									
DECISION ON DEROGATION									
1. Further to the request for derogation submitted by the Power Generating Facility Owner, the Relevant Network Operator shall assess the request and related documentation. If the request or the related documentation is considered to be incomplete the Power Generating Facility Owner shall submit the missing information as requested by the Relevant Network Operator. As from the day of the receipt of the complete request by the Relevant Network Operator until the issuance of the decision granting or refusing the derogation by the National Regulatory Authority according to Article 54(7), the Power Generating Module to which the request is referred to is deemed as compliant.					Not specifically covered in the Grid Code (other than under CP.9) but a Derogation Process does exist with the Regulator				
2. No later than six months after the receipt of the complete request according to Article 54(1) the Relevant Network Operator shall submit its assessment of the request, including a reasoned opinion, together with a related documentation and, where applicable, a Cost-Benefit Analysis to the National Regulatory Authority.									

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The above deadline shall be shortened to three months in case a reasoned request for exemption from Cost-Benefit Analysis is submitted by the Relevant Network Operator to the National Regulatory Authority.									
In case the request by the Power Generating Facility Owner is for a Type C or D Power Generating Module connected to a distribution Network or closed distribution Network the Relevant Network Operator shall obtain the assessment of the Relevant TSO within two months after notification to the Relevant TSO by the Relevant Network Operator and include it in its submission to the National Regulatory Authority.									
If the Relevant Network Operator has requested an exemption from Cost-Benefit Analysis the National Regulatory Authority shall decide on granting or refusing the exemption within one month after the receipt of this request. When the request is rejected, the Relevant Network Operator shall provide a Cost-Benefit Analysis within three months following the decision of the National Regulatory Authority.									
3. Further to the request for derogation submitted by a DSO or CDSO, the Relevant TSO shall assess the request and related documentation. If the request or the related documentation is considered to be incomplete the DSO or CDSO shall submit the missing information as requested by the Relevant TSO. As from the day of the receipt of the complete request by the DSO or CDSO until the issuance of the decision granting or refusing the derogation by the National Regulatory Authority according to Article 54(7), the Power Generating Facilities to which the request is referred to are deemed as compliant.									
4. No later than six months after the receipt of the complete request according to Article 54(3) the TSO shall submit its assessment of the request, including a reasoned opinion, together with a related documentation and, where applicable, a Cost-Benefit Analysis performed by the DSO or CDSO.									
The above deadline shall be shortened to three months in case a reasoned request for exemption from Cost-Benefit Analysis is submitted by the DSO or CDSO to the National Regulatory Authority.									
If the DSO or CDSO has requested an exemption from Cost-Benefit Analysis the National Regulatory Authority shall decide on granting or refusing the exemption within one month after the receipt of this request. If the request is rejected, the DSO or CDSO shall provide a Cost-Benefit Analysis within three months following the decision of the National Regulatory Authority.									
5. Further to the request for derogation submitted by the TSO, the National Regulatory Authority shall assess the request and related documentation. If the request or the related documentation is considered to be incomplete the TSO shall submit the missing information as requested by the National Regulatory Authority. As from the day of the receipt of the complete request by the TSO until the issuance of the decision granting or refusing the derogation by the National Regulatory Authority according to Article 54(7), the Power Generating Facilities to which the request is referred to are deemed as compliant.									

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6. Together with request according to Article 54(5) the TSO shall submit either a Cost-Benefit Analysis or a reasoned request for exemption from Cost-Benefit Analysis to the National Regulatory Authority. If the TSO has requested an exemption from Cost-Benefit Analysis the National Regulatory Authority shall decide on granting or rejecting this request within one month after the receipt of this request. When the request is rejected, the TSO shall provide a Cost-Benefit Analysis within three months following the decision of the National Regulatory Authority.									
7. The National Regulatory Authority shall issue a motivated decision granting or refusing the derogation and specifying the duration of the derogation, including a reasoned opinion, within a further three months after receipt of the complete documentation.									
8. The National Regulatory Authority shall communicate to the applicant, the Relevant Network Operator and the Agency the decision granting or rejecting the derogation. In case the applicant is a DSO or CDSO, the Relevant TSO shall be informed as well.									
9. The Agency shall monitor the procedures of derogation and the National Regulatory Authority shall cooperate with the Agency in this task and shall provide the Agency with all information necessary for this purpose.									
10. The Agency may issue a reasoned recommendation to the National Regulatory Authority to revoke any derogation, which has been granted without due justification.									
11. The National Regulatory Authority shall have the right to issue a motivated decision revoking the granted derogation under the conditions and pursuant to the provisions of national law reserving the vested interests of the concerned grid users, in the cases where the prerequisites for granting the derogation no longer exist for reasons attributable to the concerned grid users.									
Article 55									
COMPLIANCE OF EXISTING POWER GENERATING MODULES									
A Power generating Facility Owner may apply for derogation in accordance with Article 53 in relation to an Existing Power Generating Module subject to a requirement in accordance with Article 3a, for a period of twelve months from the application of that requirement.									
The Relevant Network Operator shall have the right to refuse the operation of the Power Generating Module in no application has been received within the twelve month period.									
Article 56									
REGISTER OF DEROGATIONS TO THE NETWORK CODE									
1. Each National Regulatory Authority shall maintain a register of all derogations it has granted or refused and shall provide to the Agency an updated and consolidated register at least every six months with a copy to ENTSO-E.									
2. These registers shall contain in particular:									
- the requirement(s) for which the derogation is granted or refused									
- content of the derogation									
- consequences of the granting of the derogation									

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- reasons for granting or refusing the derogation									
- whether the exemption from the performance of the cost-benefit analysis was granted.									

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Title 6									
TRANSITIONAL ARRANGEMENTS FOR EMERGING TECHNOLOGIES									
Article 57									
EMERGING TECHNOLOGIES									
1. With the exception of Article 25 of this Network Code, the requirements of this Network Code shall not apply to Power Generating Modules classified at the date of their connection to a Network as an emerging technology, in accordance with the procedures set forth in this Title.					Not specifically covered in GB Grid Code other than in respect of CC.6.3.1 which excludes Small Power Stations from meeting the requirements of CC.6.3				
2. A Power Generating Module shall be eligible to be classified pursuant to Article 60 as an emerging technology, provided that:									
- it is of Type A;									
- it is a commercially viable Power Generating Module technology; and									
- the accumulated sales of the Power Generating Module technology within a Synchronous Area at the date of application for classification as an emerging technology do not exceed 25% of the maximum level of cumulative Maximum Capacity established according to Article 58(1) a).									
Article 58									
ESTABLISHMENT OF THRESHOLDS TO CLASSIFY AS EMERGING TECHNOLOGIES									
1. No later than 3 months after the entry into force of this Network Code, all TSOs of a Synchronous Area shall determine, while respecting the provisions of Article 4(3)									
(a) a maximum level of cumulative Maximum Capacity of Power Generating Modules for emerging technologies in that Synchronous Area; and									
(b) the allocation of this maximum level of cumulative Maximum Capacity of Power Generating Modules for emerging technologies on a per Member State basis.									
2. The maximum level of cumulative Maximum Capacity of Power Generating Modules for emerging technologies in a Synchronous Area according to Article 58(1) a) shall be a single Active Power value calculated as a percentage of the previous annual maximum load in that Synchronous Area at the date of entry into force of this Network Code.									
3. The allocation per Member State according to Article 58(1) b) shall be calculated by multiplying the maximum level of cumulative Maximum Capacity of Power Generating Modules for emerging technologies of a Synchronous Area according to Article 58(1) a) with the ratio of previous annual electrical energy generated in the Member State to the total previous annual electrical energy generated in the respective Synchronous Area the Member State belongs to. For Member States partially belonging to different Synchronous Areas, the calculation will done on a pro rata basis for each of these parts and combined to give the total allocation to this Member State.									
Article 59									

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APPLICATION FOR CLASSIFICATION AS AN EMERGING TECHNOLOGY									
1. No later than 6 months after the entry into force of the Network Code, manufacturers of Type A Power Generating Modules shall be entitled to submit a request for classification of their Power Generating Module technology as an emerging technology to the National Regulatory Authority in the Member State in which they request their Power Generating Module technology to be classified as an emerging technology.									
2. Together with the request pursuant to paragraph 1 the manufacturer shall provide to the relevant National Regulatory Authority the accumulated sales of the respective Power Generating Module technology within the Synchronous Areas at the date of application for classification as an emerging technology.									
3. The request submitted pursuant to paragraph 1 shall demonstrate the compliance with the eligibility criteria set forth in Article 57(2) of this Network Code.									
ARTICLE 60									
ASSESSMENT AND APPROVAL OF REQUESTS FOR CLASSIFICATION AS AN EMERGING TECHNOLOGY									
1. Within 12 months after the entry into force of the Network Code, all National Regulatory Authorities of a Synchronous Area shall decide in a coordinated manner which Power Generating Modules, if any, should be classified as an emerging technology. This coordinated decision shall take into account the opinion of the Agency, to be issued within a three month period prior to the decision of the National Regulatory Authorities, following the request of all National Regulatory Authorities of the concerned Synchronous Area.									
2. A list of Power Generating Module technologies approved as emerging technologies shall be published by each National Regulatory Authority of a Synchronous Area.									
ARTICLE 61									
REVOCATION OF CLASSIFICATION AS AN EMERGING TECHNOLOGY									
1. Starting from the date of the decision of the National Regulatory Authority pursuant to Article 60(1), the manufacturer of any Power Generating Module technology classified as an emerging technology, shall submit on a monthly basis updates of the sales of the product by Member State in the past month to the National Regulatory Authority The National Regulatory Authority shall make publicly available the cumulative Maximum Capacity of Power Generating Modules classified as emerging technologies.									
2. In the event that the cumulative Maximum Capacity of all Power Generating Modules classified as emerging technologies connected to Networks from the date of the decision of the National Regulatory Authority pursuant to Article 60(1) exceeds the threshold established pursuant to Article 58(3), the classification as an emerging technology shall be revoked by the National Regulatory Authority. The revocation decision shall be published.									

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3. Without prejudice to the above, all National Regulatory Authorities of a Synchronous Area may decide in a coordinated manner to revoke a classification as emerging technology. This coordinated decision shall take into account the opinion of the Agency, to be issued within a three month period prior to the decision of the National Regulatory Authorities, following the request of all National Regulatory Authorities of the concerned Synchronous Area. The revocation decision shall be published by each National Regulatory Authority of a Synchronous Area.									
4. Power Generating Modules classified as emerging technologies and connected to the Network prior to the day of revocation of this classification as an emerging technology shall be considered as Existing Power Generating Modules and shall therefore be subject to the requirements of this Network Code only pursuant to the provisions of Article 3(2), Article 3(3), Article 3(4) and Article 33 of this Network Code.									
Title 7									
FINAL PROVISIONS									
Article 62									
AMENDMENT OF CONTRACTS AND GENERAL TERMS AND CONDITIONS									
All relevant clauses in contracts and relevant clauses in general terms and conditions relating to the grid connection of New Power Generating Modules shall be amended to achieve compliance with the requirements of this Network Code.									
Article 63									
ENTRY INTO FORCE									
This Network Code shall enter into force on the twentieth day following that of its publication in the *Official Journal of the European Union*.									
With the exception of Article 3(4), which shall apply [x] months after the entry into force, and Title 6 , all provisions of this Network Code shall apply as from the day of expiration of a [X] year period following its publication.									