

# **EUROPEAN NETWORK CODE: REQUIREMENT FOR GENERATORS**

## **Mapping to GB Codes**

<b>Version of RFG:</b>	Informal Draft 14/01/2014
<b>Date Mapping prepared:</b>	Article 1-23: 12 March 2014 (CMWG) Article 24-end: 27 March 2014 (CWMG)
<b>ECCAF Meeting:</b>	Articles 1-23: 27 March 2014 Articles 24 end: 29 April 2014
<b>Sent to Code Panels:</b>	TBC

All queries to ECCAF Technical Secretary, Paul Wakeley,  
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## High Level Summary – RFG

Items marked in **Green** added after the second meeting.

### **Issues to be considered by the DCRP/GCRP Workgroup (for information to ECCAF)**

**Action:** DCRP/GCRP Workgroup to consider during their work on detailed code changes.

- How D-Code/G-Code are structured going forwards:
  - Need to ensure that if requirements are in two different GB Codes they are consistent / equivalent;
  - 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;
  - How do we interpret "Relevant Network Operator":
    - This may mean that Type D requirements are different depending on if they are in England and Wales, or Scotland at 132kV
    - **For Distribution, this is being interpreted as one set of GB requirements, and not DSO specific requirements.**
- Any references to Article 4(3) need to refer to a process in the relevant GB Code and refer to the GB Governance process, with the obligation placed on the relevant TSO or DNO as per the text<sup>1</sup>.
- **Process for use of equipment certificates for compliance will need to be considered, and how certificates from outside GB are used.**

### **Issues to be flagged to DECC / Ofgem, as they form part of the GB Framework but not the GB Codes**

**Action:** DECC/Ofgem to consider how best to take forward these issues. If they feel they are part of the GB Codes, this should be flagged to ECCAF for them to reconsider.

- Scope
  - Article 3(2), Article 3(3). Legislation required to give NRA the necessary powers. Licence changes to oblige others.
  - Article 3a(1): Secondary legislation to make requirements enforceable?
  - Article 3a(2): Obligation on DECC/Ofgem
  - Article 3a(3): Legislation required to give NRA the necessary powers
  - Article 3a(4): Generators in construction / contract: Ofgem to write / lead a one-off process to consider if someone is an 'existing' generator.
- Article 4(1): Regulatory Aspects. Are changes required to modify GB Code objectives to match European objectives?
- Article 5: Cost recovery. Ofgem to consider overall approach.
- Article 6: Confidentiality. Legal advice required. Broader issues for GB under the EU Codes
- Article 14(3): Relevant Network Operator: If obligation are placed on TSOs at 132kV enforcement mechanisms may be required in GB.
- **Article 25: (Notification for Type A): A desire to tie in with Ofgem process for FIT notifications**
- **Article 33(7): Identification of costs and benefits of application of rules to Existing Power Generating Modules - Obligation placed on Authority. Do they have the ability to do this?**

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<sup>1</sup> It is noted that a number of ECCAF members would like to re-examine the governance process for the Grid Code and D-Code in light of the arrangements used in other GB codes such as the CUSC or BSC.

- o Articles 52 - 56 Derogations: Further consideration required on how Derogations will work, and how these will be addressed across- Network Codes.
- o Articles 57 – 61: Transitional Arrangements for Emerging Technologies. DECC/Ofgem to run this process.

**Issues to be considered by ECCAF:**

**Action:** ECCAF to consider how to treat these issues at their next meeting and on an ongoing basis.

Issue	ECCAF Treatment
Global issue of treatment and handling of definitions. Queries over GB vs (multiple) EU definitions	Definitions are an ongoing area of work for Commission / ENTSO-E / ACER so will park for now, to be become an ECCAF focus topic when more clarity is gained from the first Network Code to progress through Comitology as to how definitions will be handled on a pan-European level. ENTSO-E does hold a common repository of definitions in their meta-data repository <sup>2</sup> .
Article 11(4) Type D general system management requirements. At present written like central dispatch and it is not clear how they work in principle.	Drafting in ongoing and these articles may be affected. ECCAF will return to these articles once further clarity has been gained in the drafting.
Article 18. Concern over Connection Point and how this applies in GB, as all connection points are onshore in GB	
Articles 52 – 56. Consideration needs to be given to the derogation process (Title 5) in RFG, as a similar process is expected to apply across multiple Network Codes.	Hold until there is further clarity in future drafts / other Network Codes

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>Title 1</b>									
<b>GENERAL PROVISIONS</b>									
<i>Article 1</i>									
<i>Subject matter</i>									
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			
<b>Article 2</b>									
<b>DEFINITIONS</b>									
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 <sup>3</sup> and Art. 2 of Directive 2009/72/EC shall apply. In addition, the following definitions shall apply: <b>[THE CONSISTENCY OF DEFINITIONS ACROSS NETWORK CODES IS CURRENTLY BEING REVIEWED BY ENSTSO-E AND ACER]</b>							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) <b>Active Power</b> - 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) <b>Active Power Frequency Response</b> - 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) <b>Agency</b> is The Agency for the Cooperation of Energy Regulators (ACER) as established by Regulation (EC) No 713/2009									
4) <b>Alternator</b> – is a device that converts mechanical energy into electrical energy by means of a rotating magnetic field.									
5) <b>Apparent Power</b> - 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).									

<sup>3</sup> ABI ...



























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<b>Synchronous Area</b>	<b>maximum capacity threshold from which on a Power Generating Module is of Type B</b>	<b>maximum capacity threshold from which on a Power Generating Module is of Type C</b>	<b>maximum capacity threshold from which on a Power Generating Module is of Type D</b>									
	Continental Europe	1 MW	50 MW									
	Nordic	1.5 MW	10 MW									
	Great Britain	1 MW	10 MW									
	Ireland	0.1 MW	5 MW									
	Baltic	0.5 MW	10 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:												
(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												





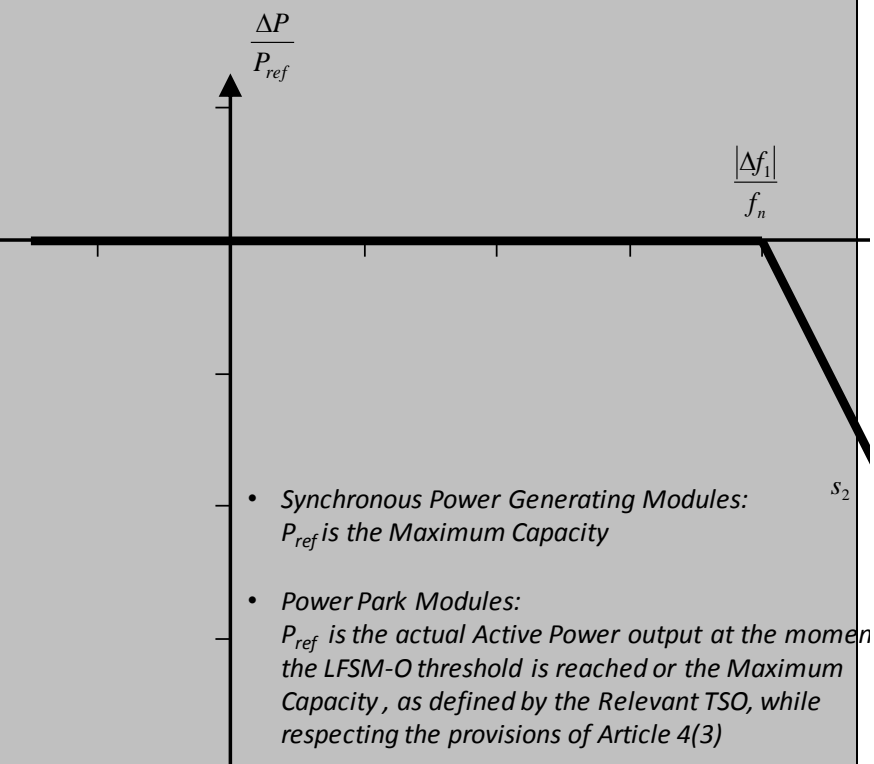
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– the requirement is related to the capability maintain constant Active Power output or to modulate Active Power output other than Article 8(1) (c) and (e).									
For the avoidance of doubt, combined heat and power generating facilities will be regarded on their electrical Maximum Capacity.									
<i>Article 4</i>									
<i>Regulatory Aspects</i>									
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.									
<i>Article 5</i>									
<i>Recovery of Costs</i>									
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.



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<b>Title 2</b>									
<b>REQUIREMENTS</b>						Provisions of Article 4(3) need to refer to governance of Codes			
<b>Chapter 1</b>									
<b>GENERAL REQUIREMENTS</b>									
<i>Article 8</i>									
<i>General requirements for type A power generating modules</i>									
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			

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(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 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			

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Synchronou s Area	Frequency Range	Time period for operation						Process in Grid Code / D-Code				
		Continental Europe	47.5 Hz – 48.5 Hz	To be defined by each TSO while respecting the provisions of Article 4(3), but not less than 30 minutes								
			48.5 Hz – 49.0 Hz	To be defined by each TSO while respecting the provisions of Article 4(3), but not less than the period for 47.5 Hz – 48.5 Hz								
	49.0 Hz – 51.0 Hz		Unlimited									
	51.0 Hz – 51.5 Hz		30 minutes									
	Nordic	47.5 Hz – 48.5 Hz	30 minutes									
		48.5 Hz – 49.0 Hz	To be defined by each TSO while respecting the provisions of Article 4(3), but not less than 30 minutes									
		49.0 Hz – 51.0 Hz	Unlimited									
		51.0 Hz – 51.5 Hz	30 minutes									
	Great Britain	47.0 Hz – 47.5 Hz	20 seconds									
		47.5 Hz – 48.5 Hz	90 minutes									
		48.5 Hz – 49.0 Hz	To be defined by each TSO while respecting the provisions of Article 4(3), but not less than 90 minutes									
		49.0 Hz – 51.0 Hz	Unlimited									
		51.0 Hz – 51.5 Hz	90 minutes									
		51.5 Hz – 52.0 Hz	15 minutes									
	Ireland	47.5 Hz – 48.5 Hz	90 minutes									
		48.5 Hz – 49.0 Hz	To be defined by each TSO while respecting the provisions of Article 4(3), but not less than 90 minutes									
		49.0 Hz – 51.0 Hz	Unlimited									
		51.0 Hz – 51.5 Hz	90 minutes									
Baltic	47.5 Hz – 48.5 Hz	To be defined by each TSO while respecting the provisions of Article 4(3), but not less than 30 minutes										
	48.5 Hz – 49.0 Hz	To be defined by each TSO while respecting the provisions of Article 4(3), but not less than the period for 47.5 Hz – 48.5 Hz										
	49.0 Hz – 51.0 Hz	Unlimited										
	51.0 Hz – 51.5 Hz	To be defined by each TSO while respecting the provisions of Article 4(3), but not less than 30 minutes										
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			

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(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									
(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									
 <ul style="list-style-type: none"> <li>• Synchronous Power Generating Modules: <math>P_{ref}</math> is the Maximum Capacity</li> <li>• Power Park Modules: <math>P_{ref}</math> 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)</li> </ul>									





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<p>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).</p>									
<p>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)</p>	<p>DOC6.3 DOC7.3 DOC7.4.1 DOC7.4.2</p>				<p>Not specified – Electronic and verbal Instructions given to BMU's and Large Power Stations</p>	<p>Obligation in <b>D-Code/G-Code</b> as appropriate.</p> <p>Procedure for how to use the right to issue instruction D-Code/G-Code</p> <p>Possible market implications, so may be consequential <b>BSC changes.</b></p>			
<p>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:</p> <ul style="list-style-type: none"> <li>– Frequency ranges, within which an automatic connection is admissible, and a corresponding delay time</li> <li>– maximum admissible gradient of increase of Active Power output</li> </ul>	<p>DPC7.3.1</p>	<p>5.3.4 Automatic Reconnection A1.3.5 Reconnection B1.3.5 Reconnection</p>	<p>10.2.3 10.5.14 11.5 Synchronizing and Operational Control</p>	<p>BSEN: 4.7 Connection and starting to generate electrical power 4.7.1 General 4.7.2 Automatic reconnection</p>		<p>Process in Grid Code</p> <p>Requirements in Grid-Code / D-Code</p>			







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<b>Voltage parameters [pu]</b>		<b>Time parameters [seconds]</b>									
U <sub>ret</sub> :	0.05 – 0.3	t <sub>clear</sub> :	0.14 – 0.15 (or 0.25 if system protection and secure operation requires)								
U <sub>clear</sub> :	0.7 – 0.9	t <sub>rec1</sub> :	t <sub>clear</sub>								
U <sub>rec1</sub> :	U <sub>clear</sub>	t <sub>rec2</sub> :	t <sub>rec1</sub> – 0.7								
U <sub>rec2</sub> :	0.85 – 0.9 and ≥ U <sub>clear</sub>	t <sub>rec3</sub> :	t <sub>rec2</sub> – 1.5								
Table 3.1 – Parameters for figure 3 for fault-ride-through capability of Synchronous Power Generating Modules.											
<b>Voltage parameters [pu]</b>		<b>Time parameters [seconds]</b>									
U <sub>ret</sub> :	0.05 – 0.15	t <sub>clear</sub> :	0.14 – 0.15 (or 0.25 if system protection and secure operation requires)								
U <sub>clear</sub> :	U <sub>ret</sub> – 0.15	t <sub>rec1</sub> :	t <sub>clear</sub>								
U <sub>rec1</sub> :	U <sub>clear</sub>	t <sub>rec2</sub> :	t <sub>rec1</sub>								
U <sub>rec2</sub> :	0.85	t <sub>rec3</sub> :	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 for gens	Not specified – Electronic and			

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(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	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		9.3.4		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			
(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.	DPC7.2.3		9.5.1 9.5.6			Requirements in Grid- Code / D-Code			
(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		10.6 Typical Protection Application Diagrams	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. Such overvoltages	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			
(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.	DPC6.3 Protection Requirements  DPC7.4.3 Protection Requirements  DPC7.4.4 Fault Ride Through and Phase Voltage Unbalance DPC7.4.5 System		11.3 Site Responsibility Schedule			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 )
(4) Power Restriction; and									
(5) Power gradient constraint.									
(d) With regard to information exchange:									
(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).					Operational 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.									
<i>Article 10</i>									
<i>General requirements for Type C power generating modules</i>									
1. Type C Power Generating Modules shall fulfil the requirements listed in Articles 8 and 9, except Article <sup>4</sup> 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.									

<sup>4</sup> Currently no Article 8(1)f in RFG. Likely a typo.







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)
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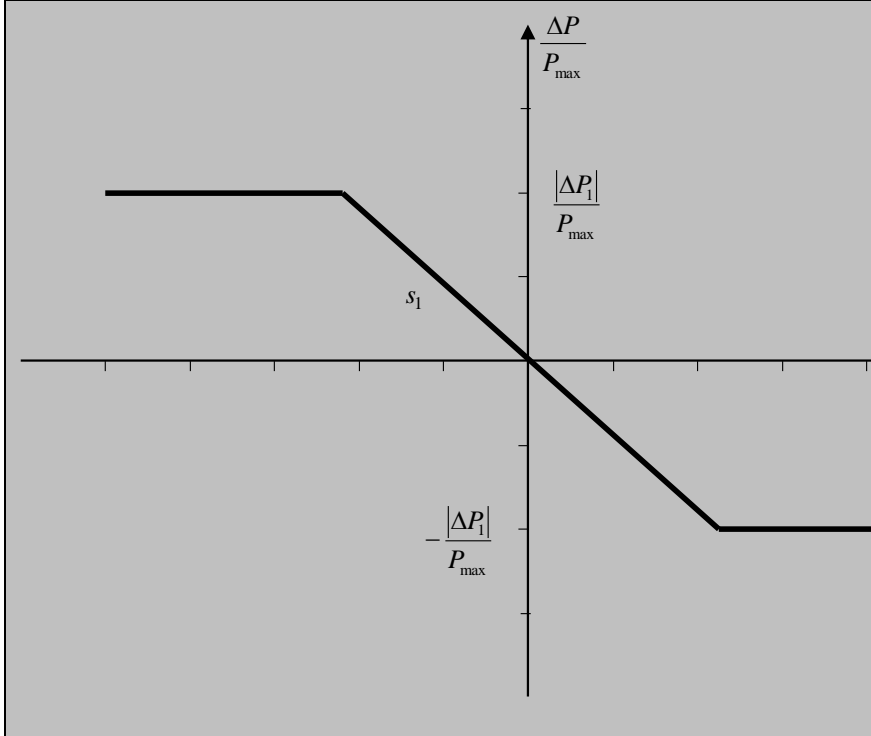


Figure 5: Active Power Frequency Response capability of Power Generating Modules in FSM illustrating the case of zero deadband and insensitivity.  $P_{max}$  is the Maximum Capacity to which  $\Delta P$  is related.  $\Delta P$  is the change in Active Power output from the Power Generating Module.  $f_n$  is the nominal Frequency (50 Hz) in the Network and  $\Delta f$  is the Frequency deviation in the Network.

Parameters	Ranges	
Active Power range related to Maximum Capacity $\frac{ \Delta P_1 }{P_{max}}$	1.5 – 10 %	
Frequency Response Insensitivity	$ \Delta f_i $	10 – 30 mHz
	$\frac{ \Delta f_i }{f_n}$	0.02 – 0.06 %
Frequency Response Deadband	0 – 500 mHz	
Droop $s_1$	2 – 12 %	

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).







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) 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.	Existing Protection		Stabilizers 9.1.3 10.5.13		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				
(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 DOC9.4.1.5  DOC9.4.3.7  DOC9.5 Re-synchronisation of De-synchronised Islands		9.2.5		CC.6.3.5 and Black Start Contracts	Grid-Code D-Code  Black Start contracts Maybe consequential change to DCUSA/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).									
(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.									
(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									







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) 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:										
– Voltage;										
– Active Power;										
– Reactive Power; and										
– 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.	



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 )
– 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			
(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			

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) 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 8.1General 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 shall, 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			
<b>Article 11</b>									
<b>GENERAL REQUIREMENTS FOR TYPE D POWER GENERATING MODULES</b>									
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						

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 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 27.		Limits and Control 9.5.1			Requirements in Grid-Code / D-Code			
(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									

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
Synchronous Area	Voltage Range	Time period for operation								
	Continental Europe	0.85 pu – 0.90 pu	60 minutes							
		0.90 pu – 1.118 pu	Unlimited							
		1.118 pu – 1.15 pu	To be decided by each TSO while respecting the provisions of Article 4(3) but not more than 60 minutes							
	Nordic	0.90 pu – 1.05 pu	Unlimited							
		1.05 pu – 1.10 pu	60 minutes							
	Great Britain	0.90 pu – 1.10 pu	Unlimited							
	Ireland	0.90 pu – 1.118 pu	Unlimited							
	Baltic	0.85 pu – 0.90 pu	30 minutes							
		0.90 pu – 1.12 pu	Unlimited							
1.12 pu – 1.15 pu		20 minutes								
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	Time period for operation								
	Continental Europe	0.85 pu – 0.90 pu	60 minutes							
		0.90 pu – 1.05 pu	Unlimited							
		1.05 pu – 1.10 pu	60 minutes							
	Nordic	0.90 pu – 1.05 pu	Unlimited							
		1.05 pu – 1.10 pu	60 minutes							
	Great Britain	0.90 pu – 1.05 pu	Unlimited							
		1.05 pu – 1.10 pu	15 minutes							
	Ireland	0.90 pu – 1.05 pu	Unlimited							
	Baltic	0.88 pu – 0.90 pu	20 minutes							
0.90 pu – 1.10 pu		Unlimited								
1.10 pu – 1.15 pu		20 minutes								
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.)										

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) 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									
(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		
(a) With regard to fault-ride-through capability of Power Generating Modules:						Requirements in Grid- Code / D-Code			
(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.									



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 )																			
<table border="1"> <thead> <tr> <th colspan="2">Voltage parameters [pu]</th> <th colspan="2">Time parameters [seconds]</th> </tr> </thead> <tbody> <tr> <td>U<sub>ret</sub>:</td> <td>0</td> <td>t<sub>clear</sub>:</td> <td>0.14 – 0.15 (or 0.25 if system protection and operational security require)</td> </tr> <tr> <td>U<sub>clear</sub>:</td> <td>0.25</td> <td>t<sub>rec1</sub>:</td> <td>t<sub>clear</sub> – 0.45</td> </tr> <tr> <td>U<sub>rec1</sub>:</td> <td>0.5 – 0.7</td> <td>t<sub>rec2</sub>:</td> <td>t<sub>rec1</sub> – 0.7</td> </tr> <tr> <td>U<sub>rec2</sub>:</td> <td>0.85 – 0.9</td> <td>t<sub>rec3</sub>:</td> <td>t<sub>rec2</sub> – 1.5</td> </tr> </tbody> </table> <p>Table 7.1 – Parameters for figure 3 for fault-ride-through capability of Synchronous Power Generating Modules.</p>			Voltage parameters [pu]		Time parameters [seconds]		U <sub>ret</sub> :	0	t <sub>clear</sub> :	0.14 – 0.15 (or 0.25 if system protection and operational security require)	U <sub>clear</sub> :	0.25	t <sub>rec1</sub> :	t <sub>clear</sub> – 0.45	U <sub>rec1</sub> :	0.5 – 0.7	t <sub>rec2</sub> :	t <sub>rec1</sub> – 0.7	U <sub>rec2</sub> :	0.85 – 0.9	t <sub>rec3</sub> :	t <sub>rec2</sub> – 1.5								
Voltage parameters [pu]		Time parameters [seconds]																												
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Voltage parameters [pu]		Time parameters [seconds]																												
U <sub>ret</sub> :	0	t <sub>clear</sub> :	0.14 – 0.15 (if system protection and operational security require)																											
U <sub>clear</sub> :	U <sub>ret</sub>	t <sub>rec1</sub> :	t <sub>clear</sub>																											
U <sub>rec1</sub> :	U <sub>clear</sub>	t <sub>rec2</sub> :	t <sub>rec1</sub>																											
U <sub>rec2</sub> :	0.85	t <sub>rec3</sub> :	1.5 – 3.0																											
<p>(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:</p> <ul style="list-style-type: none"> <li>– pre-fault minimum short circuit capacity at each Connection Point expressed in MVA;</li> <li>– 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</li> <li>– post-fault minimum short circuit capacity at each Connection Point expressed in MVA.</li> </ul>																														
<p>(c) Fault-ride-through capabilities in case of asymmetrical faults shall be defined by each TSO while respecting the provisions of Article 4(3).</p>																														
<p>4. Type D Power Generating Modules shall fulfil the following general system management requirements:</p>			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.																				
<p>(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.</p>																														
<p>(b) The Power Generating Module shall be equipped with the necessary synchronization facilities.</p>																														

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 )
(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.									
<b>Chapter 2</b>									
<b>REQUIREMENTS FOR SYNCHRONOUS POWER GENERATING MODULES</b>									
<i>Article 12</i>									
<i>Requirements for Type B synchronous power generating modules</i>									
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			
2. Type B Synchronous Power Generating Modules shall fulfil the following requirements referring to Voltage stability:	DPC7.4.2 <b>Control Arrangements</b>		11.4.2	Requirements for Generating Plant: <b>4.7.2 Voltage support by reactive power</b>		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)				





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 Synchronous Power Generating Module shall be capable of moving to any operating point within its U-Q/P <sub>max</sub> 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 <sub>max</sub> ), 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.									
<i>Article 14</i>									
<i>Requirements<sup>5</sup> for Type C synchronous power generating modules</i>									
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:									
(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;									

<sup>5</sup> Should refer to Type D; likely a typo.



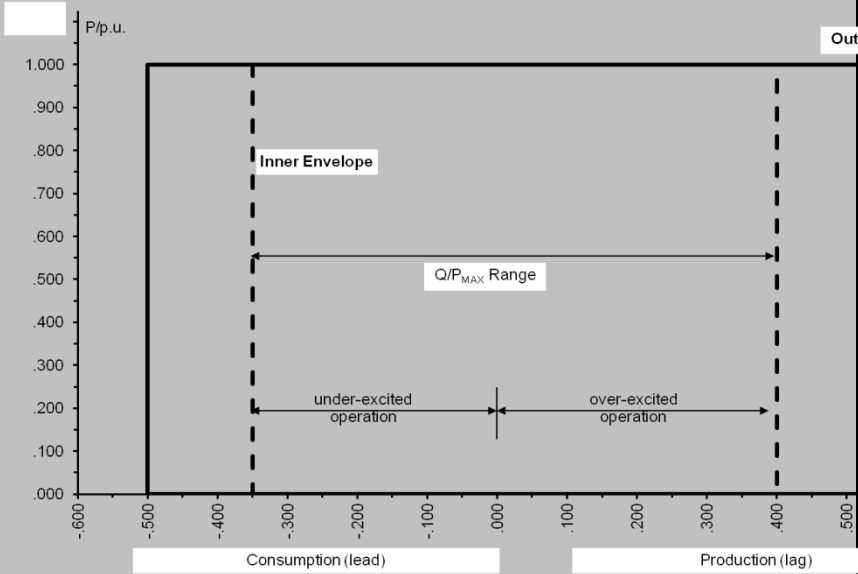








Requirements for Grid Connection of Generators 14/01/2014 Informal Draft		Equivalent Sections in Existing GB Codes				Changes to the GB Codes		ISSUE FLAGS	
		D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts	Grid Code	Proposed location	Notes	Code issue to discuss at ECCAF
Synchronous 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:									
(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.									

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) 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.									
									
<i>Figure 9 - <math>P</math>-<math>Q/P_{max}</math>-profile of a Power Park Module. The diagram represents boundaries of a <math>P</math>-<math>Q/P_{max}</math>-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 (<math>Q</math>) and the Maximum Capacity (<math>P_{max}</math>). The position, size and shape of the inner envelope are indicative.</i>									
(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:									
(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.									
					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			



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 )
(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			
(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			
<i>Article 17</i>									
<i>Requirements for Type D power park modules</i>									
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			
<b>Chapter 4</b>									
<b>REQUIREMENTS FOR OFFSHORE POWER PARK MODULES</b>									
<i>Article 18</i>									
<i>General Provisions</i>									
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.	DPC8.2.3				Onshore and Offshore requirements are treated under the same general requirements in	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.	

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. 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.					the GB Grid Code, for example CC.6.3.2 which covers reactive capability will cover both onshore and offshore requirements.	Process: 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:						Output: D-Code / Grid-Code			
(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.						Scope statement in all documents where the requirements are placed e.g. G-Code, D-Code, Engineering Recommendations			
(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.									
<i>Article 19</i>									
<i>Frequency stability requirements applicable to offshore power park modules</i>									
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			
<i>Article 20</i>									
<i>Voltage stability requirements applicable to offshore power park modules</i>									
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			







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 )
<i>Article 23</i>									
<i>General system management requirements applicable to offshore power park modules</i>									
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			
<b>Chapter 1</b>									
<b>OPERATIONAL NOTIFICATION PROCEDURE FOR CONNECTION OF NEW POWER GENERATING MODULES</b>									
<b>Article 24</b>									
<b>GENERAL PROVISIONS</b>									
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.	Guide to the Distribution Code: 6.5 Approval to Connect 6.5.1 Readiness to Connect				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).						Grid-Code / D-Code [not in guidance]	GG: publicly available, should mean freely available (not at cost).		
<i>Article 25</i>									
<i>Operation notification of Type A Power Generating Modules</i>									
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.	DPC7.3 Provision of Information	7 Commissioning/Decommissioning and Acceptance Testing 7.1 General 5.1 Connection Procedure	6 Connection Application			D-Code to include process	With some changes for aggregators		Tie in to Ofgem process for FIT notification.



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 )		
<i>Article 27</i>											
<i>Operational notification of Type B and C Power Generating Modules</i>											
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.	DPC7.4.9 <b>Commissioning Tests</b> DPC7.5  <b>Technical Requirements for Medium Power Stations</b>				CP.6.3 – Data to be submitted in accordance with the User Data File Structure which includes the Compliance Statement and front sheet.	Grid Code / D-Code	PGMD is a new document.				
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.	From Guide to prospective Users of the DNOs Distribution System: 6.5.2 Confirmation of Approval to Connect										
4. On permanent decommissioning of a Power Generating Module the Power Generating Facility Owner shall notify the Relevant Network Operator in writing.	DDRC5.3 <b>Changes to User's Data</b>		12.6.2								
5. The Relevant Network Operator shall ensure the possibility of electronic notification of operation and decommissioning of power generating modules.											
<i>Article 28</i>											
<i>Operational notification of Type D Power Generating Modules</i>											
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	Grid Code / D-Code	Taking lead from Grid Code as already existing similar process.				
– Energisation Operational Notification (EON);											
– Interim Operational Notification (ION);and											











Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes				Grid Code	Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts		Proposed location	Notes	Code issue to discuss at ECCAF	Non-code issue (send to DECC/Ofgem )
– 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;									
(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.						Not Codes			Obligation for Authority.























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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 )
<i>Article 41</i>									
<i>Compliance tests for Type B power park modules</i>									
1. Power Generating Facility Owners shall undertake LFSM-O response test compliance tests in relation to Type B Power Park Modules.						Grid Code / D-Code			
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).									
<i>Article 42</i>									
<i>Compliance tests for Type C power park modules</i>									
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						Grid Code / D-Code			
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									
(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:									

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*









Requirements for Grid Connection of Generators 14/01/2014 Informal Draft	Equivalent Sections in Existing GB Codes				Grid Code	Changes to the GB Codes		ISSUE FLAGS	
	D-Code v22	G83-2	G59-3	BSEN 50438 (micro gens) and technical drafts		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.									
<i>Article 43</i>									
<i>Compliance tests for Type D power park modules</i>									
Type D Power Park Modules are subject to the compliance tests for					As per Type C –	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 )
Type B and C Power Park Modules in the conditions as referred to in Articles 41 and 42.					See item 67 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.									
<b>Chapter 4</b>									
<b>COMPLIANCE TESTING FOR OFFSHORE POWER PARK MODULES</b>									
<i>Article 44</i>									
<i>Compliance testing for offshore power park modules</i>									
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.	Grid Code / D-Code	We are referring to GB AC Offshore. [not DC connected]	All Distribution connection points are onshore; additional complexity of onshore vs offshore in current definitions.	
<b>Chapter 5</b>									
<b>COMPLIANCE SIMULATIONS FOR SYNCHRONOUS POWER GENERATING MODULES</b>									
<i>Article 45</i>									
<i>Compliance simulations for Type B synchronous power generating modules</i>									
1. Power Generating Facility Owners shall undertake LFSM-O response test compliance tests in relation to Type B <b>Power Park Modules</b> .					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.	Grid-Code / D-Code	[[TYPO?]]		
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.							Flag to DNO / TSOs – how do we manage equipment certificates. The query is over how much may be required to be done 'live on the system'		















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) 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).									
<b>Article 50</b>									
<b>COMPLIANCE SIMULATIONS FOR TYPE D POWER PARK MODULES</b>									
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.						Grid-Code / D-Code			
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.									
<b>Chapter 7</b>									
<b>COMPLIANCE SIMULATIONS FOR OFFSHORE POWER PARK MODULES</b>									
<b>Article 51</b>									
<b>COMPLIANCE SIMULATIONS APPLICABLE TO OFFSHORE POWER PARK MODULES</b>									
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.						Grid-Code / D-Code			
<b>Chapter 8</b>									
<b>NON BINDING GUIDANCE, MONITORING, ON IMPLEMENTATION AND STAKEHOLDER INVOLVEMENT</b>									
<i>Article 51 a</i>									
<b>NON BINDING GUIDANCE ON IMPLEMENTATION</b>									
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.						Nothing required at GB level.			





















