TABLE 2 – GB Grid Code Comparison to ENTSO-E RfG

(Comparison based on GB Grid Code Issue 4 Revision 139 only and ENSTO - E RFG Internal Version dated 264 Juneanuary 2012)
(Note – Does not include other Industry Codes)

Table 2 compares the GB Grid Code with the ENTSO-E RfG. This is a much more_detailed Table comparing the exact requirements of the GB Grid Code with the exact requirements of the ENTSO-E RfG. The reader should however be aware that in adopting this comparison there may be elements in the ENTSO-E RfG that have not been identified as and this is where Table 1 is considered to be helpful. The text in highlighted yellow indicates areas which are unclear with the ENTSO-E Code or areas which are worthy of comment.

Key to Table

| Symbol | Definition |
|-------------------|--|
| N/A | Not specified in GB Grid Code but other requirements may apply in other industry Codes such as the System Operator Transmission Owner Code (STC) Distribution Code or Engineering Recommendations such as G59, ETR 113 and G83. |
| N/S | Not specified in ENTSO-E RfG Code often because not deemed to be a cross border issue but other National requirements may apply. |
| Article 4(3) | Where reference in the Table is given to Article 4(3) this means the determination of the terms and conditions for connection and access to networks or the methodologies to establish them shall be set in accordance with the rules of national law implementing Article 37 (6) (a), (7) and (10) of directive 2009/72/EC and with the principles of |
| | transparency, proportionality and non discrimination. The establishment of these terms and conditions or their methodologies shall be performed by entities and based on the legal framework indicated in this Network Code where reference is made to this paragraph, unless the rules of national law at the date of the entry into force of this Network |
| | Code assign this establishment to a different entity and according to a different legal framework. _that any decision made by a Relevant Network Operator, or Relevant TSO and a Relevant Network Operator or Power Generator may require agreement with the National Regulating Authority. |
| Article 3 (6) (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. The definition of the |
| | threshold shall be coordinated with adjacent TSOs and DSOs and shall be reviewed by the National Regulatory Authority. Power Generating Facility Owners shall assist and contribute to this determination of the threshold and provide the relevant data as requested by the Relevant TSO. The Relevant TSO shall have the right to re-assess the |
| | determination of the threshold regularly, if relevant circumstances have changed materially, but not more often than every three years and respecting the provisions of Article 4(3). A public consultation shall be conducted in the frame of the procedure for re-assessment. 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 33. |
| Article 3 (6) (c) | The Relevant TSO shall have the right to re-assess the determination of the threshold regularly, if relevant circumstances have changed materially, but not more often than every three years and respecting the provisions of Article 4(3). A public consultation shall be conducted in the frame of the procedure for re-assessment. 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 33. |
| Article 3 (6) (d) | The Relevant TSO shall have the right to re-assess the determination of the threshold regularly, if relevant circumstances have changed materially, but not more often than |
| | every three years and respecting the provisions of Article 4(3). A public consultation shall be conducted in the frame of the procedure for re-assessment. 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 33. Requirements applicable to Type D Power Generating Modules are in particular specific for higher Voltage connected generation with impact on entire system control and operation. They ensure stable operation of the interconnected Network, |
| | allowing the use of ancillary services from generation Europe wide. |
| | anoming the dee of anomaly convices from generation Europe made |
| 1 | Directly Applicable (no scope for Member State specificity) |

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| Symbol | Definition | • |
|----------|---|---|
| 2 | Member State specificity can be applied | |
| <u>3</u> | A Member state CBA or consultation is required to determine applicability | |
| <u>4</u> | Further detail is required to implement ENC obligations – need to confirm that governance processes would constitute the necessary NRA consultation | |
| <u>5</u> | No change is needed to the GB framework (we already meet the requirements). | • |
| <u>6</u> | Completely new to the GB framework | |
| <u>7</u> | Where different obligations are introduced at interconnection points to deeper in the system – with dual references required to the 2 co-existing obligations | |
| <u>8</u> | Where different obligations are introduced for new as opposed to existing parties | |
| 9 | GB arrangements go beyond those stipulated in the ENC | |

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| | | | TABLI | E 2 – GB Grid C | ode Comparison t | to ENTSO-E Rf | G | | |
|--|------------------------------------|------------|--|------------------------------------|---|---|---|---|---|
| Requirement | Plant | Key | GB Power Station Type ENTSO-E RfG- Generating Unit Type | | | | | | ре |
| _ | Type | 2 | Large | Medium | Small | D | C | B | . A |
| | | | > 100 MW (E&W) > 30 MW (SPT) > 10 MW (SHETL) | 50 – 100MW N/A (SPT / SHETL) | < 50MW < 30MW (SPT) < 10 MW (SHETL) | > 30MW or connected at 110kV or above and subject to Article 4(3) and Article 6 (d) | 30 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (c) | 1 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) | 8400W – 1 MW and connected below 110kV |
| Frequency Range (GB CC.6.1.3 ENTSO-E – Article <u>8</u> 7- 1(a)(<u>11</u>) Table 2 | Synchronous and Asynchronous | 2/5 | 51.5 – 52 Hz for 15 minutes 51 – 51.5 Hz for 90 minutes 49.0 – 51 Hz Continuous 47.5 – 49 Hz 90 minutes 47 – 47.5 Hz 20 seconds | As per Large | N/A unless directly connected | As per Type A | As per Type A | As per Type A | 51.5Hz – 52.0 Hz for 15 minutes 51 Hz – 51.5 Hz for 90 minutes 49 Hz – 51 Hz Unlimited 48.5 – 49 Hz – defined by TSO but respecting provisions of pursuant to Article 4(3) 47.5 – 48.5Hz for 90 minutes 47 – 47.5 Hz for 20 seconds |
| Voltage Operating Range (GB CC.6.1.4) (ENTSO-E – Article 109 – 3a) and Article 110 – 2 a) – 1 Tables 65.1 and 65.2) | Synchronous and Asynchronous | <u>1/5</u> | At 400 kV ±5% (although voltages between +5% and +10% will not last longer than 15 minutes) At 275 kV ± 10% At 132 kV ± 10% Below 132 kV ± 6% | As per Large | N/A unless directly connected | Between 300 kV and 400kV 0.9 p.u – 1.05 p.u unlimited and between 1.05 p.u and 1.1p.u for 15 minutes Between 110kV and 300kV 0.9 – 1.10 p.u | AsVoltage ranges and disconnection thresholds at the Connection Point defined by the Relevant Network Operator in coordination with the Relevant TSO as defined in Article 109 – 3a) whilst respecting the provisions pursuant ofte Article 4(3). | N/S | N/S |

| | | | TABL | E 2 – GB Grid Co | de Comparison | to ENTSO-E Rf0 | G | | |
|---|------------------------------------|-----|--|--|---|--|---|---|--|
| Requirement | Plant | Key | GB Power Station Type ENTSO-E RfG- Generating Unit | | | | | | ре |
| | Type | 2 | Large | Medium | Small | D | C | B | A |
| | | | > 100 MW (E&W) > 30 MW (SPT) > 10 MW (SHETL) | 50 – 100MW N/A (SPT / SHETL) | < 50MW < 30MW (SPT) < 10 MW (SHETL) | > 30MW or connected at 110kV or above and subject to Article 4(3) and Article 6 (d) | 30 – 10 MW (GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (c) | 1 – 10 MW (GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) | 8400W – 1 MW and connected below 110kV |
| Power Quality Harmonic Content (GB CC.6.1.5(a) ENTSO-E — Article 9 — 6 j1),2) | Synchronous and Asynchronous | | The harmonic distortion from all sources under both Planned Outage and fault conditions shall comply with the requirements of the Tables of Appendix A of Engineering Recommendation G5/4. The Electromagnetic Compatibility levels will be specified by NGET in the Bilateral Agreement N/A for Embedded Power Stations (Specified by DNO) | For directly Connected Power Stations – as per Large. N/A for Embedded Power Stations – specified by DNO. | N/A | As per Type C | Specified by the Relevant Network Operator which shall be consistent with National and International technical rules. N/S but note requirements for Power Quality Monitoring are covered under Article 10 (6) (1) and Article 10 (6) | N/S | N/S |
| Power Quality Phase Unbalance (GB CC.6.1.5(b)) ENTSO-E Article 9 - 6 j 1), | Synchronous and Asynchronous | 9 | For Directly Connected Users - Under Planned Outage Conditions the maximum Phase Voltage Unbalance should in England and Wales should remain below 1% | For directly Connected Power Stations – as per Large. N/A for Embedded Power Stations – specified by DNO | N/A | As per Type C | Specified by the Relevant Network Operator which shall be consistent with National and International technical rules. N/S but note requirements for Power Quality | N/S | N?S |

| | | | TABLI | E 2 – GB Grid Co | de Comparison t | to ENTSO-E Rf | G | | | |
|-----------------------------------|--------------|----------|------------------------------------|--------------------------------------|-----------------|------------------------------------|--|--|----------------------|--|
| Requirement | Plant | Key | GB | Power Station T | уре | E | ENTSO-E RfG- Generating Unit Type | | | |
| | Type | 2 | Large Large | Medium | Small | D | | В | A | |
| | | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW_(GB) | 1 – 10 MW_(GB) | <u>8</u> 400W – 1 MW | |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected | |
| | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV | |
| | | | (SHETL) | | | and subject to Article 4(3) and | subject to Article 4(3) and Article 3 | subject to Article 4(3) and Article 3 | | |
| | | | | | | Article 6 (d) | (6) (c) | (6) (b) | | |
| | | | and in Scotland | | | | Monitoring are | ,_,,_ | | |
| | | | below 2% unless | | | | covered under | | | |
| | | | abnormal | | | | Article 10 (6) (1) | | | |
| | | | conditions prevail. | | | | and Article 10 (6) (4) | | | |
| 1 | | | N/A for Embedded | | | | (4) | | | |
| | | | Power Stations – | | | | | | | |
| | | | specified by DNO | | | | | | | |
| Power Quality | Synchronous | <u>9</u> | For Directly | For directly | N/A | As per Type C | Specified by the | N/S | N/S | |
| Phase Unbalance during infrequent | and | | Connected Users - Under Planned | Connected Power Stations – as per | | | Relevant Network Operator which | | | |
| short duration | Asynchronous | | Outage Conditions | Large. | | | shall be consistent | | | |
| peaks | | | stated in | Large. | | | with National and | | | |
| (GB CC.6.1.6) | | | CC.6.1.5(b) | N/S for Embedded | | | International | | | |
| ENTSO-E - | | | infrequent short | Power Stations – | | | technical rules. | | | |
| Article 9 – 6j 1), 2) | | | duration peaks | specified by DNO | | | N/S but note | | | |
| | | | with a maximum value of 2% are | | | | requirements for Power Quality | | | |
| | | | permitted for | | | | Monitoring are | | | |
| | | | phase (voltage) | | | | covered under | | | |
| | | | unbalance subject | | | | Article 10 (6) (1) | | | |
| | | | to the prior | | | | and Article 10 (6) | | | |
| | | | agreement of NGET under the | | | | <u>(4)</u> | | | |
| | | | Bilateral | | | | | | | |
| | | | Agreement. | | | | | | | |
| | | | | | | | | | | |
| | | | N/Ae for | | | | | | | |
| | | | Embedded Power Stations – | | | | | | | |
| | | | specified by DNO | | | | | | | |
| | 1 | l | specified by DNO | | 1 | | 1 | | | |

| | | | TABLI | E 2 – GB Grid Co | de Comparison | to ENTSO-E Rf | G | | |
|---|---------------------|----------|--|--|---|---|---|--|--|
| Requirement | Plant | Key | GB | Power Station T | уре | Е | NTSO-E RfG- Ge | enerating Unit Ty | ре |
| • | Type | 2 | Large | Medium | Small | D | C | B | A |
| Voltage | Synchronous | <u>9</u> | > 100 MW (E&W) > 30 MW (SPT) > 10 MW (SHETL) | 50 – 100MW N/A (SPT / SHETL) | < 50MW < 30MW (SPT) < 10 MW (SHETL) | > 30MW or connected at 110kV or above and subject to Article 4(3) and Article 6 (d) As per Type C | 30 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (c) Specified by the | 1 – 10 MW (GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) N/S | 8400W – 1 MW and connected below 110kV |
| Fluctuations (GB CC.6.1.7(a) and (b) ENTSO-E - Article 9 - 6 j 1), 2) | and Asynchronous | ומ | Connected Users Voltage fluctuations at a Point of Common Coupling with a fluctuating load directly connected to the Onshore Transmission System shall not exceed (a) in England and Wales, 1% of the voltage level for step changes which occur repetitively. Any large voltage excursions other than step changes may be allowed up to a level of 3% provided that this does not constitute a risk to the Transmission System. In Scotland the limits for voltage level step changes are defined in P28 | Connected Power Stations – as per Large. N/A for Embedded Power Stations – specified by DNO | N/A | As per Type C | Relevant Network Operator which shall be consistent with National and International technical rules. N/S but note requirements for Power Quality Monitoring are covered under Article 10 (6) (1) and Article 10 (6) | N/S | N/S |

| | | | TABLI | E 2 – GB Grid Co | de Comparison | to ENTSO-E Rf | G | | |
|--|------------------------------------|-----|--|---|---|--|---|--|--|
| Requirement | Plant | Key | GB | Power Station T | vpe | Е | NTSO-E RfG- Ge | nerating Unit Ty | pe |
| | Туре | 2 | Large | Medium | Small | D | C | B | A |
| | | | > 100 MW (E&W) > 30 MW (SPT) > 10 MW (SHETL) | 50 – 100MW N/A (SPT / SHETL) | < 50MW < 30MW (SPT) < 10 MW (SHETL) | > 30MW or connected at 110kV or above and subject to Article 4(3) and Article 6 (d) | 30 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (c) | 1 – 10 MW (GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) | 8400W – 1 MW and connected below 110kV |
| | | | For voltages above 132 kV the Flicker Severity (short term) of 0.8 Unit and a Flicker Severity (Long Term) of 0.6 Unit for voltages of 132 kV and below, Flicker Severity *(Short Term) of 1.0 Unit and a Flicker Severity (Long Term) of 0.8 Unit, as set out in Engineering Recommendation P28 as current at the Transfer Date. N/S for Embedded Power Stations – specified by DNO. | | | | | | |
| Protection - Fault Clearance Times (CC.6.2.2.2.2(a) Article 9 – 56 (b) and Article 9 – 6b) – 2). | Synchronous and Asynchronous | 2.9 | Applicable only for Direct Connections The Protection Operating Times will be specified by NGET in the Bilateral Agreement but shall not be faster | Applicable only for Direct Connections N/A for Embedded Connections specified by DNO | Applicable only for Direct Connections N/A for Embedded Connections specified by DNO | As per Type BC | As per Type BThe Relevant Network Operator shall define the Settings necessary to protect the Network taking into account the characteristics of the Power Generating | N/S The Relevant Network Operator shall define the schemes and settings necessary to protect the Network taking into account the characteristics of the Power Generating | N/S |

| | | | TABLE | 2 – GB Grid Co | ode Comparison | to ENTSO-E Rf | G | | |
|-------------|-------|-----|---------------------|-----------------|-----------------|------------------|------------------------------------|-------------------------------------|---------------|
| Requirement | Plant | Key | GB | Power Station 1 | Гуре | E | NTSO-E RfG- Ge | enerating Unit Ty | ре |
| | Type | 2 | Large | Medium | Small | D | C | B | . . |
| | | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW (GB) | 1 – 10 MW (GB) | 8400W - 1 MW |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected |
| | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV |
| | | | (SHETL) | | | and subject to | subject to Article | subject to Article | |
| | | | | | | Article 4(3) and | 4(3) and Article 3 | 4(3) and Article 3 | |
| | | | | | | Article 6 (d) | (6) (c) | <u>(6) (b)</u> | |
| | | | than:- | | | | Facility. The | Module. The | |
| | | | | | | | Power Generating | Power Generating | |
| | | | At 400kV:- 80ms | | | | Facilities and | Module and | |
| | | | At 275kV:- 100ms | | | | Network Settings | Network Settings | |
| | | | At 132kV and | | | | relevant to the | relevant to the | |
| | | | below:- 120ms | | | | Power Generating | Power Generating | |
| | | | The probability | | | | Facility shall be co-ordinated and | Module shall be co-ordinated and | |
| | | | that the fault | | | | agreed between | agreed between | |
| | | | clearance time | | | | the Network | the Relevant | |
| | | | stated in | | | | Operator and | Network Operator | |
| | | | accordance with | | | | Generator as | and Generator as | |
| | | | the Bilateral | | | | defined in Article 9 | defined in Article 9 | |
| | | | Agreement will be | | | | 6 b) pursuant to | 5 (b) (1) whilst | |
| | | | exceeded by any | | | | Article 4(3). | respecting the | |
| | | | given fault must be | | | | | provisions of | |
| | | | less than 2%. | | | | Electrical | Article 4(3). The | |
| | | | | | | | protection of the | protection | |
| | | | N/A for Embedded | | | | Generating Unit | schemes and | |
| | | | Connections | | | | shall take | settings for | |
| | | | specified by DNO | | | | precedence over | internal power | |
| | | | | | | | operational | station faults shall | |
| | | | | | | | controls taking into | be designed not to | |
| | | | | | | | account system | jeopardise the | |
| | | | | | | | security, health | performance of a | |
| | | | | | | | and safety of staff | Power Generating | |
| | | | | | | | and the public and | Module. | |
| | | | | | | | mitigation of the damage to the | Electrical | |
| | | | | | | | Generating Unit in | protection of the | |
| | | | | | | | accordance with | Generating | |
| | | | | | | | Article 9 – 6 b),2). | Module shall take | |
| | | | | | | | | precedence over | |
| | | | | | | | | operational | |

| | | | | | de Comparison t | | | | | |
|----------------------------------|--------------|----------|-----------------------------------|---------------------------------|-----------------------------------|-----------------------------------|-------------------------------|-----------------------------------|----------------------|---------------------------------------|
| Requirement | Plant | Key | GB | Power Station T | | E | NTSO-E RfG- Ge | enerating Unit Ty | pe | |
| | Type | 2 | Large Large | Medium | Small | D | C | В | A | Formatted: Font: 8 pt, Not |
| | | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW (GB) | 1 – 10 MW (GB) | <u>8</u> 400W – 1 MW | Bold |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected | |
| | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV | |
| | | | (SHETL) | | | and subject to | subject to Article | subject to Article | | |
| | | | | | | Article 4(3) and Article 6 (d) | 4(3) and Article 3 (6) (c) | 4(3) and Article 3 (6) (b) | | |
| | | | | | | Article 6 (u) | (6) (C) | controls taking into | | |
| | | | | | | | | account system | | |
| | | | | | | | | security, health | | |
| | | | | | | | | and safety of staff | | |
| | | | | | | | | and the public and | | |
| | | | | | | | | mitigation of the | | |
| | | | | | | | | damage to the | | |
| | | | | | | | | Generating | | |
| | | | | | | | | Module in | | |
| | | | | | | | | accordance with Article 9 – 5 (b) | | |
| | | | | | | | | (2). | | |
| | | | | | | | | <u>(८).</u> | | F |
| | | | | | | | | Whilst respecting | + | Formatted: Not Highlight |
| | | | | | | | | the provisions of | | |
| | | | | | | | | Article 4(3), any | | |
| | | | | | | | | changes to the | | |
| | | | | | | | | protection | | |
| | | | | | | | | schemes shall be | | |
| | | | | | | | | agreed between | | |
| | | | | | | | | the Network Operator and | | |
| | | | | | | | | Power Generating | | |
| | | | | | | | | Facility Owner | | |
| | | | | | | | | prior to the | | |
| | | | | | | | | introduction of the | | |
| | | | | | | | | <u>changes</u> | | |
| Back Up | Synchronous | <u>9</u> | Applicable only to | Applicable only for | Applicable only for | As per Type BC | As per Type Bthe | N/S The Relevant | N/S | |
| Protection | and | | directly connected | Direct | Direct | _ | Relevant Network | Network Operator | | |
| Requirements | Asynchronous | | Generators | Connections | Connections | | Operator shall | shall define the | | |
| GB | | | to the count P - | NI/A for Fredrick 1 | NI/A for Freeboard | | define the Settings | schemes and | | |
| CC.6.2.2.2(b) ENTSO-E Article | | | In the event that clearance times | N/A for Embedded Connections | N/A for Embedded Connections – | | necessary to protect the | settings necessary | | |
| | | | defined under | specified by DNO | specified by DNO | | Protect the Network taking | to protect the Network taking | | |
| 9 – <u>5</u> 6(b) | 1 | | delined under | specified by DINO | specified by DNO | | rvetwork taking | <u>inetwork taking</u> | | |

| | | | TABLE | 2 – GB Grid C | ode Comparison t | o ENTSO-E Rf | G | | |
|-------------|-------|-----|------------------------------------|---------------|------------------|------------------|---------------------|-------------------------------------|----------------------|
| Requirement | Plant | Key | GB | Power Station | Туре | Е | NTSO-E RfG- Ge | nerating Unit Ty | ре |
| | Type | 2 | Large | Medium | Small | D | C | B | A |
| | | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW_(GB) | 1 – 10 MW_(GB) | <u>8</u> 400W – 1 MW |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected |
| | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV |
| | | | (SHETL) | | | and subject to | subject to Article | subject to Article | |
| | | | | | | Article 4(3) and | 4(3) and Article 3 | 4(3) and Article 3 | |
| | | | CC.6.2.2.2.2(a) | | | Article 6 (d) | (6) (c) | (6) (b) | |
| | | | are not met. | | | | characteristics of | into account the characteristics of | |
| | | | Generators are | | | | the Power | the Power | |
| | | | required to provide | | | | Generating Facility | Generating | |
| | | | Back-up | | | | as per Article 9 – | Module. The | |
| | | | Protection. NGET | | | | 6b) pursuant to | Power Generating | |
| | | | will also provide | | | | the requirements | Module and | |
| | | | back-up | | | | of Article 4(3) | Network Settings | |
| | | | Protection. The | | | | . , | relevant to the | |
| | | | two back-up | | | | | Power Generating | |
| | | | protections will be | | | | | Module shall be | |
| | | | co-ordinated to | | | | | co-ordinated and | |
| | | | provide | | | | | agreed between | |
| | | | discrimination. | | | | | the Relevant | |
| | | | On a Generating | | | | | Network Operator and Generator as | |
| | | | Unit or Power Park | | | | | defined in Article 9 | |
| | | | Module where only | | | | | 5 (b) (1) whilst | |
| | | | One Main | | | | | respecting the | |
| | | | protection is | | | | | provisions of | |
| | | | provided the back | | | | | Article 4(3). | |
| | | | up protection | | | | | | |
| | | | provided by the | | | | | | |
| | | | Generator is | | | | | | |
| | | | required to | | | | | | |
| | | | operate within | | | | | | |
| | | | 300ms. Where | | | | | | |
| | | | two main | | | | | | |
| | | | protections are provided or for | | | | | | |
| | | | directly connected | | | | | | |
| | | | Generators and | | | | | | |
| | | | Power Park | | | | | | |
| | | | Modules | | | | | | |

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| | | | TABLI | E 2 – GB Grid Co | de Comparison | to ENTSO-E Rf | G | | |
|---|------------------------------------|-----|---|--|---|--|--|---|--|
| Requirement | Plant | Key | GB | Power Station T | vpe | Е | NTSO-E RfG- Ge | nerating Unit Ty | pe |
| • | Type | 2 | Large | Medium | Small | D | C | B | A |
| | | | > 100 MW (E&W) > 30 MW (SPT) > 10 MW (SHETL) | 50 – 100MW N/A (SPT / SHETL) | < 50MW < 30MW (SPT) < 10 MW (SHETL) | > 30MW or connected at 110kV or above and subject to Article 4(3) and Article 6 (d) | 30 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (c) | 1 – 10 MW (GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) | 8400W – 1 MW and connected below 110kV |
| | | | connected at or below 132kV the back up clearance time shall operate to give a fault clearance time of no slower than 800ms in England and Wales and 300ms in Scotland Generators and Power Park Modules shall also be required to withstand, without tripping, the loading incurred by clearance of breaker fail protection or back up protection N/A for Embedded Connections specified by DNO | | | | | | |
| Circuit Breaker Fail Protection CC.6.2.2.2(c)(d) ENTSO-E – Article 9 – 56(b). | Synchronous and Asynchronous | 9 | The Generator is required to provide circuit breaker fail protection for direct connections at 400 or 274kV and for direct connections in Scotland at 132 | Applicable only for Direct Connections N/A for Embedded Connections— specified by DNO | Applicable only for Direct Connections N/A for Embedded Connections – specified by DNO | As per Type BC | As per Type BThe Relevant Network Operator shall define the Settings necessary to protect the Network taking into account the characteristics of | N/S The Relevant Network Operator shall define the schemes and settings necessary to protect the Network taking into account the characteristics of | N/S |

| | TABLE 2 – GB Grid Code Comparison to ENTSO-E RfG | | | | | | | | | |
|-------------------------------------|--|------|---------------------------------|------------------------|------------------|-------------------------|------------------------------------|------------------------------------|----------------------|--|
| Requirement | Plant | Key | GB | Power Station T | уре | E | NTSO-E RfG- Ge | nerating Unit Ty | ре | |
| · | Type | 2 | Large | Medium | Small | D | C | B | A | |
| | | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW (GB) | 1 – 10 MW_(GB) | <u>8</u> 400W – 1 MW | |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected | |
| | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV | |
| | | | (SHETL) | | | and subject to | subject to Article | subject to Article | | |
| | | | | | | Article 4(3) and | 4(3) and Article 3 (6) (c) | 4(3) and Article 3 (6) (b) | | |
| | | | kV. In the event of | | | Article 6 (d) | the Power | the Power | | |
| | | | a protection | | | | Generating Facility | Generating | | |
| | | | system failure | | | | as per Article 9 – | Module. The | | |
| | | | circuit breaker fail | | | | 6b) but pursuant | Power Generating | | |
| | | | is required to | | | | to the | Module and | | |
| | | | initiate tripping so | | | | requirements of | Network Settings | | |
| | | | as to interrupt fault | | | | Article 4(3). | relevant to the | | |
| | | | current within the | | | | | Power Generating | | |
| | | | next 200ms. The target | | | | | Module shall be co-ordinated and | | |
| | | | performance for | | | | | agreed between | | |
| | | | the System Fault | | | | | the Relevant | | |
| | | | Dependability | | | | | Network Operator | | |
| | | | index shall be not | | | | | and Generator as | | |
| | | | less than 99%. | | | | | defined in Article 9 | | |
| | | | N/A / E | | | | | 5 (b) (1) whilst | | |
| | | | N/A for Embedded Connections | | | | | respecting the provisions of | | |
| | | | specified by DNO | | | | | Article 4(3). | | |
| Protection | Synchronous | 2, 5 | For direct | As per Large for | As per Large for | As per type BC | As per Type | Agreed between | | |
| Equipment to be | and | =1.0 | connections the | Directly connected | Directly | 7.0 pc. type <u>2</u> 0 | BAgreed between | the Network | | |
| provided | Asynchronous | | following | and Embedded | Connected and | | the Network | Operator and | | |
| GB CC.6.2.2.3 | | | mandatory | Plant | Embedded Plant | | Operator and | Power Generating | | |
| ENTSO-E Article | | | requirements are | | | | Power Generating | Module respecting | | |
| 9 – <u>56(</u> -b) – 3), | | | necessary | | | | Facility pursuant to | the provisions of | | |
| Article 9 – 6 b) c) | | | Loss of Excitation | | | | Article 4(3). The | Article 4(3). The | | |
| and <u>Article 9 (5)</u> | | | protection | | | | protection systems can include the | protection systems can include the | | |
| a <u>(c</u>) | | | No busbar, mesh | | | | following | following | | |
| | | | corner circuit | | | | requirements | requirements | | |
| | | | breaker fail | | | | - 4 | | | |
| | | | protection | | | | External and | External and | | |
| | | | equipment or AC | | | | internal short | internal short | | |
| | | 1 | or DC wiring may | | | | circuit | circuit | | |

| | TABLE 2 – GB Grid Code Comparison to ENTSO-E RfG | | | | | | | | | |
|-------------|--|-----|---------------------|---------------|-----------------|------------------|---------------------------------------|-------------------------------------|----------------------|--|
| Requirement | Plant | Key | GB | Power Station | Туре | Е | NTSO-E RfG- Ge | nerating Unit Ty | ре | |
| • | Type | 2 | Large | Medium | Small | D | C | B | A | |
| | | | > 100 MW (E&W) | 50 - 100MW | < 50MW | > 30MW or | 30 – 10 MW (GB) | 1 – 10 MW (GB) | <u>8</u> 400W – 1 MW | |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected | |
| | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV | |
| | | | (SHETL) | | | and subject to | subject to Article | subject to Article | | |
| | | | | | | Article 4(3) and | 4(3) and Article 3 | 4(3) and Article 3 | | |
| | | | | | | Article 6 (d) | (6) (c) | <u>(6) (b)</u> | | |
| | | | be worked upon in | | | | Asymmetric load | Asymmetric load | | |
| | | | the absence of a | | | | (Negative Phase | (Negative Phase | | |
| | | | representative | | | | sequence) | sequence) | | |
| | | | from NGET | | | | Stator and rotor | Stator and rotor | | |
| | | | | | | | overload | <u>overload</u> | | |
| | | | In addition, the | | | | Over/under | Over/under | | |
| | | | following | | | | excitation | <u>excitation</u> | | |
| | | | requirements shall | | | | Over / under | Over / | | |
| | | | apply as specified | | | | undervoltage at | undervoltage at | | |
| | | | by NGET in the | | | | the connection | the Connection | | |
| | | | Bilateral | | | | point | <u>Point</u> | | |
| | | | Agreement | | | | Over / under | Over / under | | |
| | | | Protection of | | | | voltage at the | voltage at the | | |
| | | | Interconnecting | | | | alternator | Alternator | | |
| | | | Connections | | | | terminals | <u>Terminals</u> | | |
| | | | Circuit Breaker | | | | Inter-area | Inter-area | | |
| | | | Fail | | | | oscillations . | <u>oscillations</u> | | |
| | | | Pole Slipping | | | | Robustness | Inrush Current | | |
| | | | Protection | | | | against power | Asynchronous | | |
| | | | (Synchronous | | | | swings (for | operation (pole | | |
| | | | Plant only) | | | | example angle | slip) | | |
| | | | Signals for Tariff | | | | and voltage | Protection against | | |
| | | | Metering | | | | stability . | inadmissible shaft | | |
| | | | and the co- | | | | Over and | torsions (for | | |
| | | | ordination of relay | | | | underfrequency | <u>example</u> | | |
| | | | settings | | | | Asynchronous | subsynchronous | | |
| | | | across the | | | | operation (pole | <u>resonance</u> | | |
| | | | Connection Point. | | | | Slip) | Power Generating | | |
| | | | For Embedded | | | | Protection against inadmissible shaft | Module line | | |
| | | | Generators the | | | | torsions (for | <u>protection</u> | | |
| | | | requirements will | | | | | Unit transformer | | |
| | | | be specified by the | | | | example subsynchronous | <u>protection</u> Backup schemes | | |
| | | | DNO at the | | | | resonance | against protection | | |
| | | 1 | DINO at the | | l I | 1 | resonance | auainsi projection | | |

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| | TABLE 2 – GB Grid Code Comparison to ENTSO-E RfG | | | | | | | | | |
|-------------|--|-----|-----------------------------|---------------|-----------------|-----------------------------------|--------------------------------------|----------------------------------|----------------------|--|
| Requirement | Plant | Key | GB | Power Station | Туре | ENTSO-E RfG Generating Unit Type | | | | |
| • | Type | 2 | Large | Medium | Small | D | C | B | A | |
| | | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW_(GB) | 1 – 10 MW (GB) | <u>8</u> 400W – 1 MW | |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected | |
| | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV | |
| | | | (SHETL) | | | and subject to | subject to Article | subject to Article | | |
| | | | | | | Article 4(3) and | 4(3) and Article 3 | 4(3) and Article 3 | | |
| | | | | | | Article 6 (d) | (6) (c) | (6) (b) | | |
| | | | connection point other than | | | | Generating Unit line protection | and switchgear malfunction | | |
| | | | requirements for | | | | Unit transformer | Overfluxing (U/f) | | |
| | | | Pole Slipping | | | | protection | Inverse power | | |
| | | | protection and | | | | Backup schemes | Rate of change of | | |
| | | | Tariff Metering | | | | against protection | frequency | | |
| | | | Signals | | | | and switchgear | Neutral voltage | | |
| | | | | | | | malfunction | displacement as | | |
| | | | | | | | Overfluxing | per Article 9 – 5 b) | | |
| | | | | | | | Inverse power | <u>3).</u> | | |
| | | | | | | | Rate of change of | 1 1 100 101 | | |
| | | | | | | | frequency Neutral voltage | In addition with | | |
| | | | | | | | displacement as | regard to priority ranking of | | |
| | | | | | | | per Article 9 – 6 b) | protection and | | |
| | | | | | | | 3). | control the Power | | |
| | | | | | | | O). | generating facility | | |
| | | | | | | | In addition with | owner shall | | |
| | | | | | | | regard to priority | organise their | | |
| | | | | | | | ranking of | protections and | | |
| | | | | | | | protection and | control devices in | | |
| | | | | | | | control the Power | compliance with | | |
| | | | | | | | generating facility | the following | | |
| | | | | | | | shall organise their protections and | priority ranking | | |
| | | | | | | | control devices in | organised in decreasing order | | |
| | | | | | | | compliance with | of importance | | |
| | | | | | | | the following | <u>or importance</u> | | |
| | | | | | | | priority ranking | Network System | | |
| | | | | | | | organised in | and Generating | | |
| | | | | | | | decreasing order | Module Protection | | |
| | | | | | | | of importance | Synthetic Inertia (if | | |
| | | | | | | | | applicable) | | |
| | | | | | | | Network System | Frequency Control | | |

| | TABLE 2 – GB Grid Code Comparison to ENTSO-E RfG | | | | | | | | | | |
|--|--|-----|--|------------------------------------|---|--|---|---|--|--|--|
| Requirement | Plant | Key | GB | Power Station T | ype | E | NTSO-E RfG- Ge | enerating Unit Ty | ре | | |
| · | Type | 2 | Large | Medium | Small | D | C | B | A | | |
| | | | > 100 MW (E&W) > 30 MW (SPT) > 10 MW (SHETL) | 50 – 100MW N/A (SPT / SHETL) | < 50MW < 30MW (SPT) < 10 MW (SHETL) | > 30MW or connected at 110kV or above and subject to Article 4(3) and Article 6 (d) | 30 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (c) | 1 – 10 MW (GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) | 8400W – 1 MW and connected below 110kV | | |
| | | | | | | | and Generating Unit Protections Synthetic Inertia (if applicable) Frequency Control (Active Power adjustment) Power Restriction and Power gradient constraints as per Article 9—6 c). In the event of loss of stability of a single generating unit it shall automatically disconnect in order to support system security and prevent damage to the Generating Unit as per Article 9—6—d) pursuant to the requirements of Article 4(3). | (Active Power adjustment) Power Restriction and Power gradient constraints as per Article 9 – 5 c). | | | |
| Short Circuit Ratio GB CC.6.3.2(a) (ENTSO-E – Article 34 – 3. | Synchronous | 9 | For plant of 1600MVA or greater no less than 0.4. For Plant less than 1600MVA no less | No less than 0.5 | N/A | As per Type B <u>N/S</u> | As per type B N/S | N/SNo less than 0.5 unless a lower value is specified by the TSO pursuant to the requirements of | N/S | | |

| Requirement | Plant | Key | 1 | Power Station | ode Comparison i Type | ENTSO-E RfG– Generating Unit Type | | | | |
|---|--------------|-------------|-------------------|----------------|--------------------------|-----------------------------------|---|---------------------------------------|----------------------|--|
| oquo | Туре | 2 | Large | Medium | Small | D | C | B | A | |
| | . , , , | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW (GB) | 1 – 10 MW (GB) | <u>8</u> 400W – 1 MW | |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected | |
| | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV | |
| | | | (SHETL) | - , | , , | and subject to | subject to Article | subject to Article | | |
| | | | | | | Article 4(3) and | 4(3) and Article 3 | 4(3) and Article 3 | | |
| | | | | | | Article 6 (d) | <u>(6) (c)</u> | <u>(6) (b)</u> | | |
| | | | than 0.5 | | | | | Article 4(3). | | |
| Short Circuit Ratio GB CC.6.3.2(a) (ENTSO-E — Article 34 — 3. | Asynchronous | <u>9</u> | Not applicable | Not applicable | Not applicable | Not applicable | Not applicable | Not applicable | Not applicable | |
| Reactive | Synchronous | <u>2, 8</u> | 0.85 PF Lead to | As per Large | N/S | As per Type C | Where the | The Relevant | N/S | |
| Capability (GB - | | | 0.95 Lag at Rated | | | | Connection Point | Network Operator | | |
| CC.6.3.2) | | | MW Output at | | | | is not at the | shall have the | | |
| (ENTSO-E | | | Generator Unit | | | | location of the | right to define | | |
| Synchronous – Article 1 <mark>21</mark> – 2(a), | | | Terminals | | | | <u>high voltage</u> terminals of the | (while respecting the provisions of | | |
| Article 1 <u>2</u> + - 2 <u>1</u> a), Article 1 <u>3</u> 2 - <u>2</u> 3(a) | | | | | | | step up | Article 4(3)) the | | |
| and (b) | | | | | | | transformer or at | capability of a | | |
| Asynchronous | | | | | | | the Alternator | synchronous | | |
| rticle 1 <u>5</u> 4- <u>2</u> 1)(a), | | | | | | | Terminals, | Power Generating | | |
| Article 16 – 3(a). | | | | | | | <u>supplementary</u> | Module to provide | | |
| (b) and (c) | | | | | | | Reactive Power | Reactive Power as | | |
| | | | | | | | may be defined by | per Article 12 -2 | | |
| | | | | | | | the Relevant Network Operator | (a). Specified by the Relevant | | |
| | | | | | | | while respecting | Network Operator | | |
| | | | | | | | the provisions of | at the high voltage | | |
| | | | | | | | Article 4(3) to | terminals of the | | |
| | | | | | | | compensate for | step up | | |
| | | | | | | | the Reactive | transformer at the | | |
| | | | | | | | Power demand | Connection Point | | |
| | | | | | | | of the high voltage | or at the alternator | | |
| | | | | | | | line or cable as per Article 13 – 2 | terminals if no transformer exists | | |
| | | | | | | | <u>(a).</u> | as per Article 11 – | | |
| | | | | | | | /a). | 2a) pursuant to | | |
| | | | | | | | The Voltage - | the requirements | | |
| | | | | | | | Q/P _{max} profile is | of Article 4(3). | | |

Formatted Table

| | TABLE 2 – GB Grid Code Comparison to ENTSO-E RfG | | | | | | | | | | |
|-------------|--|-----|----------------|-----------------|-----------------|------------------|---|--------------------|----------------------|--|--|
| Requirement | Plant | Key | GB | Power Station 1 | Гуре | E | NTSO-E RfG- Ge | enerating Unit Ty | ре | | |
| • | Type | 2 | Large | Medium | Small | D | | B | A | | |
| | | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW_(GB) | 1 – 10 MW (GB) | <u>8</u> 400W – 1 MW | | |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected | | |
| | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV | | |
| | | | (SHETL) | | | and subject to | subject to Article | subject to Article | | | |
| | | | | | | Article 4(3) and | 4(3) and Article 3 | 4(3) and Article 3 | | | |
| | | | | | | Article 6 (d) | (6) (c) | (6) (b) | | | |
| | | | | | | | defined by the | | | | |
| | | | | | | | Relevant Network Operator in | | | | |
| | | | | | | | coordination with | | | | |
| | | | | | | | the Relevant TSO | | | | |
| | | | | | | | whilst respecting | | | | |
| | | | | | | | the provisions of | | | | |
| | | | | | | | Article 4(3) and in | | | | |
| | | | | | | | accordance with | | | | |
| | | | | | | | the following:- | | | | |
| | | | | | | | | | | | |
| | | | | | | | <u>.range (at 1p.u</u> voltage) at the | | | | |
| | | | | | | | Connection Point | | | | |
| | | | | | | | (ie the HV side of | | | | |
| | | | | | | | the Generator | | | | |
| | | | | | | | Transformer. The | | | | |
| | | | | | | | reactive range | | | | |
| | | | | | | | shall be between | | | | |
| | | | | | | | (0.89 PF and 0.92 | | | | |
| | | | | | | | PF) lead to (0.87 | | | | |
| | | | | | | | PF to 0.83 PF) lag | | | | |
| | | | | | | | in accordance with Figure 7. In Great | | | | |
| | | | | | | | Britain the | | | | |
| | | | | | | | maximum Q/Pmax | | | | |
| | | | | | | | range is defined | | | | |
| | | | | | | | as 0.95 which | | | | |
| | | | | | | | equates to 0.90PF | | | | |
| | | | | | | | lead to 0.9 PF lag | | | | |
| | | | | | | | at a steady state | | | | |
| | | | | | | | voltage range of | | | | |
| | | | | | | | 0.1p.u as per Table 8 The mid | | | | |

| | TABLE 2 – GB Grid Code Comparison to ENTSO-E RfG | | | | | | | | | | |
|-------------|--|-----|----------------|-----------------|-----------------|------------------|------------------------------------|--------------------|----------------------|--|--|
| Requirement | Plant | Key | GB | Power Station 1 | Гуре | E | NTSO-E RfG- Ge | nerating Unit Ty | ре | | |
| - | Type | 2 | Large | Medium | Small | D | C | B | A | | |
| | | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW (GB) | 1 – 10 MW_(GB) | <u>8</u> 400W – 1 MW | | |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected | | |
| | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV | | |
| | | | (SHETL) | | | and subject to | subject to Article | subject to Article | | | |
| | | | | | | Article 4(3) and | 4(3) and Article 3 | 4(3) and Article 3 | | | |
| | | | | | | Article 6 (d) | (6) (c) | <u>(6) (b)</u> | | | |
| | | | | | | | point can be | | | | |
| | | | | | | | adjusted to | | | | |
| | | | | | | | provide more capability in the | | | | |
| | | | | | | | leading or lagging | | | | |
| | | | | | | | mode. Equates to | | | | |
| | | | | | | | approx 0.92 PF | | | | |
| | | | | | | | lead to 0.876 PF | | | | |
| | | | | | | | lag at Rated MW | | | | |
| | | | | | | | Output as | | | | |
| | | | | | | | specified by the | | | | |
| | | | | | | | TSO pursuant to | | | | |
| | | | | | | | Article 4(3). The | | | | |
| | | | | | | | Synchronous | | | | |
| | | | | | | | Power Generating | | | | |
| | | | | | | | Module shall be | | | | |
| | | | | | | | capable of moving to any operating | | | | |
| | | | | | | | point within its U- | | | | |
| | | | | | | | Q/Pmax profile in | | | | |
| | | | | | | | appropriate | | | | |
| | | | | | | | timescales to | | | | |
| | | | | | | | values specified | | | | |
| | | | | | | | by the Relevant | | | | |
| | | | | | | | Network Operator. | | | | |
| | | | | | | | | | | | |
| | | | | | | | When operating at | | | | |
| | | | | | | | an Active Power | | | | |
| | | | | | | | output below | | | | |
| | | | | | | | <u>maximum</u> | | | | |
| | | | | | | | Capacity the | | | | |
| | | | | | | | synchronous Generating | | | | |
| | | | | | | | Module shall be | | | | |

| | TABLE 2 – GB Grid Code Comparison to ENTSO-E RfG | | | | | | | | | | |
|-------------|--|-----|---|------------------------------------|---|--|---|---|--|--|--|
| Requirement | Plant | Key | GB | Power Station | Туре | Е | NTSO-E RfG- Ge | nerating Unit Ty | ре | | |
| _ | Type | 2 | Large | Medium | Small | D | C | B | A | | |
| | | | > 100 MW (E&W) > 30 MW (SPT) > 10 MW (SHETL) | 50 – 100MW N/A (SPT / SHETL) | < 50MW < 30MW (SPT) < 10 MW (SHETL) | > 30MW or connected at 110kV or above and subject to Article 4(3) and Article 6 (d) | 30 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (c) | 1 – 10 MW (GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) | 8400W – 1 MW and connected below 110kV | | |
| | | | | | | | capable of operating over the full range of Figure 7 at least down to the minimum Stable operating level. | | | | |
| | Asynchronous | 2,8 | 0.95 PF Lead to 0.95 PF Lag at Rated MW output. Capability to meet requirements of Fig 1 of Connection Conditions. In Scotland the reactive capability of 0.95 Power Factor Lead to Power Factor Lag applies at the HV Side of the Connecting Transformer at 132kV, 275kV or 400kV. | As per Large | N/A | As per Type C | Voltage — C/P max range (at 1p.u voltage) at the Connection Point. Equates to approx 0.97 PF lead to 0.92 PF lag at Rated MW Output as specified by the TSO. At lower Active Power outputs the Power Park Module must operate as specified by the TSO and remain consistent to the Q/P max range anywhere in the operating diagram of Figure 11 pursuant to Article 4(3) Where the Connection Point is not at the location of the | As per Type AThe Relevant Network Operator shall have the right to specify the reactive capability of the Power Park Module whilst respecting the provisions of Article 4(3). | N/Sspecified by the Relevant DSO-in accordance with Article 14 – 1a) but must be pursuant to Article 4(3). | | |

| | TABLE 2 – GB Grid Code Comparison to ENTSO-E RfG | | | | | | | | | | | |
|-------------|--|-----|----------------|---------------|-----------------|------------------|-----------------------------------|--------------------|----------------------|--|--|--|
| Requirement | Plant | Key | GB | Power Station | Туре | E | NTSO-E RfG- Ge | nerating Unit Ty | ре | | | |
| - | Type | 2 | Large | Medium | Small | D | | B | A | | | |
| | | | > 100 MW (E&W) | 50 - 100MW | < 50MW | > 30MW or | 30 – 10 MW_(GB) | 1 – 10 MW (GB) | <u>8</u> 400W – 1 MW | | | |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected | | | |
| | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV | | | |
| | | | (SHETL) | | | and subject to | subject to Article | subject to Article | | | | |
| | | | | | | Article 4(3) and | 4(3) and Article 3 | 4(3) and Article 3 | | | | |
| | | | | | | Article 6 (d) | (6) (c) high voltage | <u>(6) (b)</u> | | | | |
| | | | | | | | terminals of the | | | | | |
| | | | | | | | step up | | | | | |
| | | | | | | | transformer or at | | | | | |
| | | | | | | | the Power Park | | | | | |
| | | | | | | | Module if no step | | | | | |
| | | | | | | | up transformer | | | | | |
| | | | | | | | <u>exists),</u> | | | | | |
| | | | | | | | 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 as | | | | | |
| | | | | | | | <u>per Article 16 – 3</u> (a). | | | | | |
| | | | | | | | <u>(a).</u> | | | | | |
| | | | | | | | For Power Park | | | | | |
| | | | | | | | Modules the | | | | | |
| | | | | | | | Voltage - Q/P _{max} | | | | | |
| | | | | | | | profile at | | | | | |
| | | | | | | | maximum capacity | | | | | |
| | | | | | | | is defined by the | | | | | |
| | | | | | | | Relevant Network | | | | | |
| | | | | | | | Operator in coordination with | | | | | |
| | | | | | | | the Relevant TSO | | | | | |

| Damidaamaart | Dlant | I/ avi | | | ode Comparison | | | neveline Heit To | | |
|--------------|-------|--------|----------------|-----------------|-----------------|-----------------------------------|-------------------------------|-------------------------------|----------------------|-----------------------------|
| Requirement | Plant | Key | | Power Station 1 | | | NTSO-E RfG- Ge | | | |
| | Туре | 2 | Large Large | Medium | Small | D | C | B | A | Formatted: Font: 8 pt, Not |
| | | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW_(GB) | 1 – 10 MW <u>(GB)</u> | <u>8</u> 400W – 1 MW | Bold |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected | |
| | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV | |
| | | | (SHETL) | | | and subject to | subject to Article | subject to Article | | |
| | | | | | | Article 4(3) and Article 6 (d) | 4(3) and Article 3 | 4(3) and Article 3 (6) (b) | | |
| - | | + | | | | Article 6 (u) | (6) (c) whilst respecting | <u>(0) (D)</u> | | |
| | | | | | | | the provisions of | | | |
| | | | | | | | Article 4(3) and in | | | |
| | | | | | | | accordance with | | | |
| | | | | | | | the following:- | | | |
| | | | | | | | the following. | | | |
| | | | | | | | .The reactive | | | |
| | | | | | | | range shall be | | | |
| | | | | | | | between (0.89 PF | | | Formatted: Highlight |
| | | | | | | | and 0.94 PF) lead | | 1 | - Tormattea: Highlight |
| | | | | | | | to (0.93 PF to 0.84 | | | |
| | | | | | | | PF) lag in | | | |
| | | | | | | | accordance with | | | |
| | | | | | | | Figure 8. In Great | | | |
| | | | | | | | Britain the | | | |
| | | | | | | | maximum Q/Pmax | | | |
| | | | | | | | range is defined | | | |
| | | | | | | | as 0.66 which | | | Formatted: Highlight |
| | | | | | | | equates to 0.95 | | | Formattade Highlight |
| | | | | | | | PF lead to 0.95 PF | | | Formatted: Highlight |
| | | | | | | | lag at a steady state voltage | | | |
| | | | | | | | range of 0.1p.u as | | | |
| | | | | | | | per Table 9. | | | |
| | | | | | | | per rable 3. | | | |
| | | | | | | | When operating at | | | |
| | | | | | | | an Active Power | | | |
| | | | | | | | output below | | | |
| | | | | | | | maximum | | | |
| | | | | | | | Capacity, the | | | |
| | | | | | | | Power Park | | | |
| | | | | | | | Module shall be | | | |
| | | | | | | | capable of a | | | |
| | | 1 | | | 1 | 1 | Reactive | | 1 | |

| | | | TABL | E 2 – GB Grid Co | de Comparison | to ENTSO-E Rf | G | | |
|-------------|-------|-----|----------------|------------------|-----------------|------------------------------------|---------------------------------------|-------------------------------|----------------------|
| Requirement | Plant | Key | GB | Power Station 1 | Гуре | Е | NTSO-E RfG- Ge | nerating Unit Ty | pe |
| • | Type | 2 | Large | Medium | Small | D | C | B | A |
| | | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW_(GB) | 1 – 10 MW (GB) | <u>8</u> 400W – 1 MW |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected |
| | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV |
| | | | (SHETL) | | | and subject to Article 4(3) and | subject to Article | subject to Article | |
| | | | | | | Article 4(3) and Article 6 (d) | 4(3) and Article 3 (6) (c) | 4(3) and Article 3 (6) (b) | |
| | | | | | | Article o (u) | Capability as | (0) (0) | |
| | | | | | | | specified by the | | |
| | | | | | | | Relevant Network | | |
| | | | | | | | Operator in | | |
| | | | | | | | coordination with | | |
| | | | | | | | the Relevant TSO whilst respecting | | |
| | | | | | | | the provisions of | | |
| | | | | | | | Article 4(3) and in | | |
| | | | | | | | accordance with | | |
| | | | | | | | the principles of | | |
| | | | | | | | Figure 9. | | |
| | | | | | | | The reactive | | |
| | | | | | | | range shall be | | |
| | | | | | | | between (0.89 PF | | |
| | | | | | | | and 0.94 PF) lead | | |
| | | | | | | | to (0.93 PF to 0.84 | | |
| | | | | | | | PF) lag in | | |
| | | | | | | | accordance with Figure 9. In Great | | |
| | | | | | | | Britain the | | |
| | | | | | | | maximum Q/Pmax | | |
| | | | | | | | range is defined | | |
| | | | | | | | as 0.66 which | | |
| | | | | | | | equates to 0.95 | | |
| | | | | | | | PF lead to 0.95 PF lag at a steady | | |
| | | | | | | | state voltage | | |
| | | | | | | | range of 0.1p.u as | | |
| | | | | | | | per Table 9. The | | |
| | | | | | | | P-Q/Pmax profile | | |
| | | | | | | | can be of any | | |
| | | 1 | | | 1 | I | shape and shall | 1 | |

| | | | TABLI | E 2 – GB Grid C | ode Comparison | | | | | |
|---|--------------|-------------|-------------------|-----------------|-----------------|------------------|---------------------------------------|--------------------|-----------------|-----------------------------|
| Requirement | Plant | Key | GB | Power Station | Туре | E | NTSO-E RfG- Ge | enerating Unit Ty | ре | |
| • | Type | 2 | Large Large | Medium | Small | D | C | B | . | Formatted: Font: 8 pt, Not |
| | | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW_(GB) | 1 – 10 MW_(GB) | 8400W - 1 MW | Bold |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected | |
| | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV | |
| | | | (SHETL) | | | and subject to | subject to Article | subject to Article | | |
| | | | | | | Article 4(3) and | 4(3) and Article 3 | 4(3) and Article 3 | | |
| | | | | | | Article 6 (d) | (6) (c) | <u>(6) (b)</u> | | |
| | | | | | | | include conditions | | | |
| | | | | | | | for reactive power capability at zero | | | |
| | | | | | | | Active Power. | | | |
| | | | | | | | MOLIVE T OWEL. | | | |
| | | | | | | | When operating at | | | |
| | | | | | | | an Active Power | | | |
| | | | | | | | output below the | | | |
| | | | | | | | <u>Maximum</u> | | | |
| | | | | | | | Capacity the | | | |
| | | | | | | | Power Park | | | |
| | | | | | | | Module shall be capable of | | | |
| | | | | | | | providing Reactive | | | |
| | | | | | | | Power at any | | | |
| | | | | | | | operating point | | | |
| | | | | | | | inside the inner | | | Formatted: Highlight |
| | | | | | | | and outer limits of | | | Tormatteu: riigriiigrit |
| | | | | | | | Figure 9. | | | |
| | | | | | | | With some Power | | | |
| | | | | | | | Park units | | | |
| | | | | | | | unavailable within | | | |
| | | | | | | | the Power Park Module the | | | |
| | | | | | | | Reactive | | | |
| | | | | | | | Capability will be | | | |
| | | | | | | | reduced. | | | |
| Output Power with | Synchronous | <u>2, 5</u> | Power Output not | As per Large | N/A | As per Type AC | As per Type | As per Type AN/S | N/S The Power | 1 |
| Falling Frequency | <u>and</u> | | to fall more than | " | | | ASpecified by | | Generating | |
| (GB - CC.6.3.3) | Asynchronous | | pro-rata with | | | | TSO pursuant to | | Module is | |
| (ENTSO-E | | | frequency as per | | | | Article 4(3) but | | required to | |
| Synchronous - | | | Figure 2 of | | | | within the | | <u>maintain</u> | |
| Article <u>8 (1)</u> | | | Connection | | | | boundaries of | | constant output | |
| <u>(d)(e)</u> 2 – 2 (<u>e)</u> a) | | 1 | Conditions | | | 1 | Below 49Hz - | | at its target | |

| Requirement | Plant | Key | GRI | Power Station 1 | vne | F | NTSO-E RfG- Ge | nerating Unit Tv | ne | |
|-----------------|---------|----------|----------------|-----------------|-----------------|------------------|--------------------------------------|-----------------------|-------------------------------|----------------------------|
| ricquirement | Type | <u>2</u> | Large | Medium | Small | D | CC | B | A | Formatted: Font: 8 pt, Not |
| | . , , , | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW <u>(GB)</u> | 1 – 10 MW <u>(GB)</u> | 8400W – 1 MW | Bold |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected | 20.0 |
| | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV | |
| | | | (SHETL) | - , | (-) | and subject to | subject to Article | subject to Article | | |
| | | | , | | | Article 4(3) and | 4(3) and Article 3 | 4(3) and Article 3 | | |
| | | | | | | Article 6 (d) | <u>(6) (c)</u> | <u>(6) (b)</u> | | |
| and (b) | | | | | | | maximum | | Active Power | |
| Asynchronous | | | | | | | reduction rate of | | value regardless | |
| (Not Specified) | | | | | | | 2% of maximum | | of frequency | |
| | | | | | | | capability per 1Hz frequency drop | | <u>changes.</u> ◆ | Formatted: Centered |
| | | | | | | | below 49 Hz | | In addition the | |
| | | | | | | | Below 49.5 Hz up | | output power | |
| | | | | | | | to a maximum | | with falling | |
| | | | | | | | reduction rate of | | frequency shall | |
| | | | | | | | 10% of maximum | | be specified by | |
| | | | | | | | capacity per 1Hz | | the TSO but | |
| | | | | | | | frequency drop below 49.5 Hz. | | within the | |
| | | | | | | | below 49.5 Hz. | | boundaries of | |
| | | | | | | | | | Figure 2 which are between :- | |
| | | | | | | | | | are between | |
| | | | | | | | | | 1) Below 49Hz 🔸 | Formatted: Left |
| | | | | | | | | | falling by a | Formatted: Left |
| | | | | | | | | | reduction rate of | |
| | | | | | | | | | 2% of maximum | |
| | | | | | | | | | capability at | |
| | | | | | | | | | 50Hz per 1Hz | |
| | | | | | | | | | frequency drop | |
| | | | | | | | | | <u>and</u> | |
| | | | | | | | | | 2) Below 49.5 Hz | |
| | | | | | | | | | by a reduction | |
| | | | | | | | | | rate of 10% of | |
| | | | | | | | | | the maximum | |
| | | | | | | | | | capacity at 50 Hz | |
| | | | | | | | | | per 1 Hz | |
| | | | | | | | | | frequency drop. | |
| | | | | | 1 | 1 | | | 1 | |

| | | | TABLE | 2 – GB Grid Co | de Comparison | to ENTSO-E Rf | G | | |
|--|-------------|-------------|---|------------------------------------|---|--|--|--|--|
| Requirement | Plant | Key | GB | Power Station 1 | Гуре | Е | NTSO-E RfG- Ge | nerating Unit Ty | ре |
| • | Type | 2 | Large | Medium | Small | D | | B | A |
| | | | > 100 MW (E&W) > 30 MW (SPT) > 10 MW (SHETL) | 50 – 100MW N/A (SPT / SHETL) | < 50MW < 30MW (SPT) < 10 MW (SHETL) | > 30MW or connected at 110kV or above and subject to Article 4(3) and Article 6 (d) | 30 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (c) | 1 – 10 MW (GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) | 8400W – 1 MW and connected below 110kV |
| Voltage Changes in the normal operating Range (GB – CC.6.3.4 (Synchronous ENTSO-E – Article 121 – (2),(a), Article 132 – 23(ba)(1),-a Article 13 2(b)(3) and Article 13 (2)(c),nd (b)) | Synchronous | <u>2. 9</u> | Reactive Power output under steady state conditions should be within the voltage range of ±5% at 400kV, 275kV and 132 kV and lower voltages | As per Large | N/A | As per Type C | Power Generating ModulesUnit areis required to meet a Voltage – Q/P _{Max} curve over a varying voltage range at maximum capacity as specified by the TSO whilst respectingpursuan tte Article 4(3) at both full load (Article 132 - 23(ba) (1) and (3) —(2). For lower loads the requirements are covered under and Article 132 - 23(cb) although | Relevant Network Operator DSO to define requirement as per Article 121- (2)(a) whilst respecting the provisions of pursuant to Article 4(3). | is limited to a selection of affected generation technologies and may be subject to further conditions defined by the relevant TSO while respecting the provisions of Article 4(3). N/S |

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| | | | TABLE | 2 – GB Grid C | ode Comparison | to ENTSO-E Rf | G | | |
|---|------------------------------------|-----|--|------------------------------------|---|--|---|---|---|
| Requirement | Plant | Key | GB | Power Station | Туре | Е | NTSO-E RfG- Ge | nerating Unit Ty | ре |
| • | Type | 2 | Large | Medium | Small | D | C | B | A |
| | | | > 100 MW (E&W) > 30 MW (SPT) > 10 MW (SHETL) | 50 – 100MW N/A (SPT / SHETL) | < 50MW < 30MW (SPT) < 10 MW (SHETL) | > 30MW or connected at 110kV or above and subject to Article 4(3) and Article 6 (d) | 30 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (c) | 1 – 10 MW (GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) | 8400W – 1 MW and connected below 110kV |
| | | | | | | | the requirements on voltage range are unclear at lower loads. | | |
| Voltage Changes in the normal operating Range (GB – CC.6.3.4 (Asynchronous ENTSO-E – Article 154 – 24(a), Article 16 - 3(b) (1) and Article 16 – 3(c) (Asynchronous | Asynchronous | 2,9 | As per Synchronous but in addition requirements for voltage and reactive power requirements if Embedded and connected at 33kV and below are also specified | As per Large | N/Ae | As per Type C | Relevant Network Operator to define whilst respecting the provisions of Article 4(3) Power Park Module is required to meet a Voltage — Q/P _{Meet} curve as specified by the TSO pursuant to Article 4(3) at both full load (Article 16 3(b) and Article 16 -3(c) at lower loads. | As per Type B. Relevant Network Operator to define whilst respecting the provisions of Article 4(3) | N/SDSO-te define requirement as per Article 14– 1(a) pursuant to Article 4(3). |
| Black Start (GB CC.6.3.5) ENTSO-E – Article 109 – 5(a) | Synchronous and Asynchronous | 2 | Specified by NGET in the Bilateral Agreement | As per Large | Not applicable | As per Type C | Not a mandatory requirement but specified by the Relevant TSO can obtain a quote for a Black Start service whilst respecting the provisions of pursuant to Article 4(3) depending upon System Security in a Synchronous | N/S | N/S |

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| | | | TABLI | E 2 – GB Grid Co | ode Comparison | to ENTSO-E Rf | G | | |
|---|------------------------------------|-------------|---|------------------------------------|---|--|--|--|--|
| Requirement | Plant | Key | GB | Power Station | Гуре | ENTSO-E RfG Generating Unit Type | | | |
| • | Type | 2 | Large | Medium | Small | D | C | B | A |
| | | | > 100 MW (E&W) > 30 MW (SPT) > 10 MW (SHETL) | 50 – 100MW N/A (SPT / SHETL) | < 50MW < 30MW (SPT) < 10 MW (SHETL) | > 30MW or connected at 110kV or above and subject to Article 4(3) and Article 6 (d) | 30 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (c) | 1 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) | 8400W – 1 MW and connected below 110kV |
| Contribution to | Synchronous | <u>5</u> | Required | As per Large | Not applicable | As per Type C | area. Required | N/S | N/S |
| Frequency Control by continuous Modulation of Active Power (GB – CC.6.3.6(a) ENTSO-E – Article 910 – 2(a) and Article 10 – 2(c). | | | | | | | | | |
| Contribution to Frequency Control by continuous Modulation of Active Power (GB – CC.6.3.6(a) ENTSO-E – Article 109 – 2(a) and Article 10 - 2(c) | Asynchronous | <u>5</u> | Required unless the Power Park Module is in Scotland and has a Registered Capacity of less than 50MW. | As per Large | N/A | As per Synchronous | As per Synchronous | N/S | N/S |
| Contribution to Voltage Control by continuous Modulation of Reactive Power (GB – CC.6.3.6(b) ENTSO-E Article 124 – 2(ba) and | Synchronous and Asynchronous | <u>1, 5</u> | Required | As per Large | N/A | As per Type BC | As per Type BRequired as per Article 12 – 3 pursuant to Article 4(3). | Synchronous Power Generating Modules are required to have a permanent automatic excitation system to control | N/S |

| TABLE 2 – GB Grid Code Comparison to ENTSO-E RfG | | | | | | G | | | |
|--|---------------------|-------------|----------------|----------------------|-----------------|------------------|---------------------|--|----------------------|
| Requirement | Plant | Key | GB | Power Station | Туре | E | NTSO-E RfG- Ge | enerating Unit Ty | ре |
| | Type | 2 | Large | Medium | Small | D | C | B | A |
| | | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW_(GB) | 1 – 10 MW_(GB) | <u>8</u> 400W – 1 MW |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected |
| | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV |
| | | | (SHETL) | | | and subject to | subject to Article | subject to Article | |
| | | | | | | Article 4(3) and | 4(3) and Article 3 | 4(3) and Article 3 | |
| (le) and Auticle 10 | | | | | | Article 6 (d) | <u>(6) (c)</u> | (6) (b) | |
| (b) and Article 12 | | | | | | | | Alternator terminal | |
| -3 | | | | | | | | voltage as per Article 12- | |
| | | | | | | | | 2(b). Required as | |
| | | | | | | | | specified by the | |
| | | | | | | | | Relevant DSO in | |
| | | | | | | | | accordance with | |
| | | | | | | | | Article 11 - 2(a) | |
| | | | | | | | | and (b) and | |
| | | | | | | | | pursuant to Article | |
| | | | | | | | | 4 (3) | 1110 |
| Contribution to | Synchronous | <u>2, 5</u> | Required | As per Large | N/A | As per Type C | Required as per | N/S - Note | N/S |
| Voltage Control by continuous | and Asynchronous | | | | | | Article 162 – 3 (d) | however that Article 15 – 2 (a) | |
| Modulation of | Asyliciliolious | | | | | | 4 (3) . | allows the | |
| Reactive Power | | | | | | | 1(0) . | Relevant Network | |
| (GB – CC.6.3.6(b) | | | | | | | | Operator (whilst | |
| ENTSO-E Article | | | | | | | | respecting Article | |
| 1 <u>6</u> 1 – 2(a) and (b) | | | | | | | | 4(3) to provide a | |
| and Article 12 | | | | | | | | Reactive Power | |
| 3 <u>(d)</u> | | | | | | | | Capability but not | |
| | | | | | | | | specify the | |
| | | | | | | | | requirement to | |
| | | | | | | | | <u>provide voltage</u> <u>control.</u> Required | |
| | | | | | | | | as specified by the | |
| | | | | | | | | Relevant DSO in | |
| | | | | | | | | accordance with | |
| | | | | | | | | Article 11 – 2(a) | |
| | | | | | | | | and (b) and | |
| | | | | | | | | pursuant to Article | |
| II . | | 1 | | | | | | 4(3) | |

| TABLE 2 – GB Grid Code Comparison to ENTSO-E RfG | | | | | | | | | |
|--|------------------------------------|-------------|--|------------------------------------|---|--|---|---|--|
| Requirement | Plant | Key | GB | Power Station T | ype | E | NTSO-E RfG- Ge | nerating Unit Ty | ре |
| | Type | 2 | Large | Medium | Small | D | | B | A |
| | | | > 100 MW (E&W) > 30 MW (SPT) > 10 MW (SHETL) | 50 – 100MW N/A (SPT / SHETL) | < 50MW < 30MW (SPT) < 10 MW (SHETL) | > 30MW or connected at 110kV or above and subject to Article 4(3) and Article 6 (d) | 30 – 10 MW (GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (c) | 1 – 10 MW (GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) | 8400W – 1 MW and connected below 110kV |
| Requirement for Power Station to be fitted with a Proportional Turbine Speed Governor GB – CC.6.3.7(a) ENTSO-E - Article 109 – 2(a) and Article 102 – 24(ca) | Synchronous | 1, 2, 7 | Required | Required | N/A | As per Type C | Required as per Article 109 – 2(a) and in accordance with the requirements of the TSO / Relevant Network Operator pursuant to Article 4(3) and Article 102 – 24(ca) | N/S | N/S |
| Requirement for Power Station to be fitted with a Proportional Turbine Speed Governor GB – CC.6.3.7(a) ENTSO-E - Article 109 – 2(a) and Article 102 – 24(ca) | Asynchronous | 1, 2, 7 | Required except in relation to Power Park Modules in Scotland which have a Registered Capacity of less than 50MW | Required | N/A | As per Type C | Required as per Article 9 – 2(a) As per Synchronous | N/S | N/S |
| Requirement for Frequency Controller or Governor to be designed and operated to an appropriate standard / specification (GB - CC.6.3.7(a)(i),(ii) ENTSO-E - | Synchronous and Asynchronous | <u>2. 5</u> | Required except in relation to Power Park Modules in Scotland which have a Registered Capacity of less than 50MW | Required | N/A | As per Type C | Required as specified in Article 109 – 2(de) whilst respecting the requirements of pursuant to Article 4(3) | N/S | N/S |

| | | | | | ode Comparison t | | | | |
|--------------------------------|--------------|----------------|------------------------------|---------------|------------------|------------------|--|--|-------------------------|
| Requirement | Plant | Key | GB | Power Station | 71 | | | enerating Unit Ty | pe |
| | Type | 2 | Large Large | Medium | Small | D | C | B | A |
| | | | > 100 MW (E&W) | 50 - 100MW | < 50MW | > 30MW or | 30 – 10 MW (GB) | 1 – 10 MW_(GB) | <u>8</u> 400W – 1 MW |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected |
| | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV |
| | | | (SHETL) | | | and subject to | subject to Article | subject to Article | |
| | | | | | | Article 4(3) and | 4(3) and Article 3 | 4(3) and Article 3 | |
| A .: 1 . 100 | | | | | | Article 6 (d) | <u>(6) (c)</u> | <u>(6) (b)</u> | |
| Article <u>10</u> 9 – | | | | | | | | | |
| 2(<u>d</u> e). | | | | | | | | | |
| Requirement for | Synchronous | 2, 5, 7 | Required | Required | N/A | As per Type C | Required as per | Required for | N/SStable |
| the Frequency | and | | (Not applicable to | | | | Article 109 – | reducing power | operation is |
| Controller or Turbine speed | Asynchronous | | Power Park Modules in | | | | 2 <u>whilst</u> | output in steps no more than 20% of | required whilst |
| Governor to | | | Scotland which | | | | respecting the requirements of | maximum capacity | the Power Generating |
| Control the | | | have a Registered | | | | pursuant to Article | as Sspecified by | Module is |
| Generating Unit or | | | Capacity of less | | | | 4(3) as defined in | Relevant Network | operating in |
| Power Park | | | than 50MW) | | | | Article 10 - 2 | Operator whilst | Limited Over |
| Module Active | | | than solvivy) | | | | AITIOIC TO Z | respecting the | Frequency |
| Power with | | | | | | | | requirements of | Sensitive Mode |
| stability over the | | | | | | | | Article 4(3) in | in accordance |
| entire operating | | | | | | | | accordance with | with Article 8 - |
| range | | | | | | | | Article <u>98</u> – 2(a) | 1(c)(2) |
| (GB CC.6.3.7 (b) | | | | | | | | pursuant to Article | |
| ENTSO-E - Article | | | | | | | | 4 (3). | |
| 8 <u>1 (c)(2),- 2 and</u> | | | | | | | | | |
| Article 9 – 2(a) | | | | | | | | | |
| and Article 10 – 2. | | | | | | | | | |
| Ability of a | Synchronous | <u>2, 4, 9</u> | Required | Required | N/A | As per Type C | Required as | N/S | N/S |
| Generating Unit | and | | (Not applicable to | | | | specified by | | |
| Frequency | Asynchronous | | Power Park | | | | Relevant Network | | |
| Controller or Governor to | | | Modules in Scotland which | | | | Operator in co- ordination with the | | |
| control system | | | have a Registered | | | | Relevant and TSO | | |
| frequency below | | | Capacity of less | | | | in accordance with | | |
| 52Hz unless this | | | than 50MW) | | | | Article 109 – 5(b) | | |
| causes the | | | lian solvivy) | | | | whilst respecting | | |
| Generating Unit or | | | | | | | the provisions of | | |
| Power Park | | | | | | | pursuant to Article | | |
| Module to operate | | | | | | | 4(3). | | |

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| | | | | E 2 – GB Grid Co | | | | | | |
|-------------------------------|--------------|-------------|----------------------------------|------------------------|-----------------|------------------|-----------------------------|--------------------|---------------------------|-----------------------------------|
| Requirement | Plant | Key | GB | Power Station T | уре | | NTSO-E RfG- Ge | nerating Unit Ty | ре | |
| - | Type | 2 | Large | Medium | Small | D | C | B | - A | Formatted: Font: 8 pt, Not |
| | | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW_(GB) | 1 – 10 MW_(GB) | <u>8</u> 400W – 1 MW | Bold |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected | |
| | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV | |
| | | | (SHETL) | | | and subject to | subject to Article | subject to Article | | |
| | | | | | | Article 4(3) and | 4(3) and Article 3 | 4(3) and Article 3 | | |
| below its | | | | | | Article 6 (d) | <u>(6) (c)</u> | <u>(6) (b)</u> | | |
| designed | | | | | | | | | | |
| minimum | | | | | | | | | | |
| operating level. | | | | | | | | | | |
| . (GB | | | | | | | | | | |
| CC.6.3.7(c)(i)) | | | | | | | | | | |
| (ENTSO-E - | | | | | | | | | | |
| rticle <u>10</u> 9 – 5(b) | | | | | | | | | | |
| Sovernor Droop | Synchronous | 2, 5 6* | Droop Setting to | Droop Setting to | N/A | As per Type C | For Plant in | As per Type A | Not specified for | |
| or Frequency | and | <u>6*</u> | be between 3 and | be between 3 and | | | <u>Limited Under</u> | | Plant in | |
| Control Droop (GB CC.6.3.7 | Asynchronous | | 5% | 5% | | | Frequency Sensitive Mode | | Frequency Sensitive Mode. | |
| (C)(ii)) | | | (Not applicable to Power Park | | | | Droop specified by | | For Plant | |
| NTSO-E Article | | | Modules in | | | | the Relevant TSO | | operating in | |
| ² – 1(c)(12), and | | | Scotland which | | | | but must be | | Limited | |
| Article 109 –(2) | | | have a Registered | | | | between 2 and | | Frequency | |
| od)(-1) - Table | | | Capacity of less | | | | 120% as detailed | | Sensitive Mode | |
| and Article 10 0 | | | than 50MW) | | | | in Article 109 – | | Droop is defined | |
| (c)(1) - Table 4. | | | | | | | 2 <u>(bd) – (1) - *New</u> | | by the TSO but | Formatted: Highlight |
| | | | | | | | to GB Framework | | must be between | 3 3 1 |
| | | | | | | | - Table 3 | | the range of 2 | |
| | | | | | | | For Direction | | and 12% as per | |
| | | | | | | | For Plant in | | Article <u>8</u> 7 – | |
| | | | | | | | Frequency Sensitive Mode | | 1(c)(<u>1</u> 2) | |
| | | | | | | | Droop specified by | | | |
| | | | | | | | the Relevant TSO | | | |
| | | | | | | | but must be | | | |
| | | | | | | | between 2 – 12% | | | |
| | | | | | | | as detailed in | | | |
| | | | | | | | Article 10 – 2(c)(1) | | | |
| | | | | | | | <u>– Table 4.</u> | | | |
| Frequency | Synchronous | <u>2, 5</u> | Deadband to be | Deadband to be | N/A | As per Type C | For Plant in | N/S | Ne/S ← - | Formatted Table |
| Control /Governor | and | l | 0.03 Hz or \pm | 0.03Hz or ± | | | Frequency | | | |

| | | | | | de Comparison | | | | |
|--------------------|-----------------|--------------|---------------------|------------------------|-----------------|-------------------|---------------------------------|--------------------|---------------|
| Requirement | Plant | Key | GB | Power Station T | | | NTSO-E RfG- Ge | enerating Unit Ty | pe |
| | Type | 2 | Large Large | Medium | Small | D | C | B | .A |
| | | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW (GB) | 1 – 10 MW (GB) | 8400W - 1 MW |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected |
| | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV |
| | | | (SHETL) | | | and subject to | subject to Article | subject to Article | |
| | | | | | | Article 4(3) and | 4(3) and Article 3 | 4(3) and Article 3 | |
| | | | | | | Article 6 (d) | <u>(6) (c)</u> | <u>(6) (b)</u> | |
| Deadband | Asynchronous | | 0.015Hz | 0.015Hz | | | Sensitive Mode | | |
| Settings | | | (Not applicable to | | | | Deadband | | |
| (GB | | | Power Park | | | | specified by the | | |
| CC.6.3.7(c)(iii)) | | | Modules in | | | | Relevant TSO but | | |
| ENTSO-E - | | | Scotland which | | | | must be between | | |
| Article 109 – | | | have a Registered | | | | 0 – 0.5 Hz as | | |
| 2)(cd) - 1 – Table | | | Capacity of less | | | | detailed in Article | | |
| <u>4</u> 3 | | | than 50MW) | | | | 109 - (2)(cd) - 1 - Table 43 | | |
| Target Frequency | Synchronous | 9 | Unit Load | Unit Load | N/A | As per Type | Defined by the | N/S | N/S |
| Settings | and | <u>9</u> | Controller or | Controller or | IN/A | CN/C | TSO with the | IV/3 | 11/3 |
| GB CC.6.3.7 (d) | Asynchronous | | Power Park | Power Park | | 0 11/0 | target frequency | | |
| ENTSO-E Article | Asyliciliolious | | Module Load | Module Load | | | range set between | | |
| 9 – 2) d) - 8) | | | Controller to a | Controller to a | | | 49.9 and 50.1 Hz | | |
| 5 L) u) 0) | | | Target Frequency | Target Frequency | | | as defined in | | |
| | | | either continuously | either continuously | | | Article 9 – 2) d) - | | |
| | | | or in a maximum | or in a maximum | | | 8) N/S — Only | | |
| | | | of 0.05Hz steps | of 0.05Hz steps | | | covered in G&D's | | |
| | | | over at least the | over at least the | | | | | |
| | | | range of 50 \pm | range of 50 \pm | | | | | |
| | | | 0.1Hz | 0.1Hz | | | | | |
| | | | (Not applicable to | | | | | | |
| | | | Power Park | | | | | | |
| | | | Modules in | | | | | | |
| | | | Scotland which | | | | | | |
| | | | have a Registered | | | | | | |
| | | | Capacity of less | | | | | | |
| | | | than 50MW) | | | | | | |
| Frequency | Synchronous | <u>2, 6*</u> | Generating Units | Generating Units | N/A | As per Type C | Parameters for | N/S | N/S |
| Performance | and | | and Power Park | and Power Park | | | frequency | | |
| Requirements for | Asynchronous | | Modules must be | Modules must be | | | response | | |
| Plant operating in | | | capable of | capable of | | | performance | | |
| Frequency | | | providing at least | providing at least | | | specified by the | | |
| Sensitive Mode | | | 10% of their | 10% of their | | | Relevant TSO in | | |

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| Solid Williams Soli | | | | TABLI | E 2 – GB Grid Co | de Comparison | to ENTSO-E Rf | G | | | |
|--|-----------------------|-------|-----|----------------|------------------------|-----------------|----------------|------------------|------------------|----------------------|-----------------------------------|
| > 100 MW (EAW) S 0 - 100 MW (SF) NA (SF) | Requirement | Plant | Key | GB | Power Station T | уре | E | NTSO-E RfG- Ge | nerating Unit Ty | ре | |
| Salar (SPT) SHETL | • | Type | _ | Large | Medium | Small | | | | • | Formatted: Font: 8 pt, Not |
| SHETL S | | | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW (GB) | 1 – 10 MW (GB) | <u>8</u> 400W – 1 MW | Bold |
| (SHETL) Registered (And Appendix 3 of the GB Connection Conditions (ENTSO-E Article 109 _ [2 (sd)) Registered Capacity (when subject to a ± | | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected | |
| (GB CC.6.3.7(e) and Appendix 3 of the GB Connection Conditions (CBTSO: E Article 199 – 12 (cd)) (CBTSO: E Article 199 – 12 (cd)) (CBTSO: E Article 199 – 12 (cd)) (CA 3.3 Note – Primary Response – defined an Figures of Active Power gradually increasing over the period 0 – 10 seconds and southerd of a southerd of a southerd of a subject to a ± 0.51± change or greater(and proportionally for lower frequency changes) as Primary, Secondary and Harticle 199 – 12 (cd) – but in general these are similar to that required by the GB Grid Code. The Retevant TSO must define the parameters for High frequency response defined in Figures CC.A.3.1 CC.A.3.2 and CC.A.3.2 and CC.A.3.3 Note – Primary Response – defined as additional release of Active Power gradually increasing over the period 0 – 10 seconds and southerd of a souther of a southerd o | | | | | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV | |
| (GB CC.6.3.7(e) and Appendix 3 of the GB Connection Conditions (ENTSO-E Article 109 – [2 (cd)) Registered Capacity (when subject to a ± 0.5Hz change or greater (and proportionally for lower frequency changes)) as Primary, Secondary and High Frequency Response as defined in Figures CC.A.3.1, CC.A.3.2 and CC.A.3.3 Note – Primary Response defined as additional releases of Active Fower frequency the period 0 – 10 seconds and sustained for a further 20 seconds, Secondary Response – Active Power gradually released over the Power gradually Response Active Power gradually released over the Power gradually Response Active Power gradually Response Active Power gradually Response Active | | | | (SHETL) | | | | | | | |
| (GB CC.6.3.7(e) and Appendix 3 of the GB Connection Conditions (ENTSO-E Article 109 – [2 (cst)) (CA3-2 (cst)) (CA3-2 (cst)) (CA3-2 (cst)) (CA3-3 (cst) (CA3-1, CC.4.3.1, CC.4.3.1, CC.4.3.3, Note – Primary Response – defined as additional release of Active Power gradually increasing over the period 0 – 10 seconds and sustained for a further 20 seconds, Secondary Response – Active Power gradually released over the expected over the subject to a ± 0.5Hz change or greater(and proportionally tor lower frequency changes) as Primary, Secondary and High Frequency Response as defined in Figures CC.4.3.1, CC.4.3.2 and CC.4.3.3 Note – Primary Response – defined as additional release of Active Power gradually increasing over the period 0 – 10 seconds and sustained for a further 20 seconds, Secondary Response – Active Power gradually released over the Power shall be schiefed as accordance with Article 1090 (2g) (cgl) - Dut in general these are similar to that required by the GB Grid Code. The Relevant TSO must define the pendix Dep (109 cc) Response Active Power shall be Relevant TSO must define the required by the GB Grid Code. The Relevant TSO must define the required by the GB Grid Code. The Relevant TSO must define the required by the GB Grid Code. The Relevant TSO must define the required by the GB Grid Code. The Relevant TSO must define the required by the GB Grid Code. The Relevant TSO must define the required by the GB Grid Code. The Relevant TSO must define the required by the GB Grid Code. The Relevant TSO must define the required by the GB Grid Code. The Relevant TSO must defi | | | | | | | | | | | |
| and Appendix 3 of the GB Connection subject to a ± 0.5Hz change or greater (and proportionally for lower frequency changes) as Primary, Secondary and High Frequency Responses as defined in Figures CC.A.3.1, CC.A.3.2 and CC.A.3.3, Note – Primary Response — defined as additional release of Active Power gradually increasing over the period 0 – 10 seconds and sustained for a further 20 seconds, Secondary Response. Active Power gradually released over the expense of the process of Secondary Response. Active Power gradually released over the expense of the process of Secondary Response. Active Power gradually released over the expense Active Power power power power power | | | | | | | Article 6 (d) | | <u>(6) (b)</u> | | |
| the GB Connection Conditions (ENTSOE Article 109 – (2 (cd)) Subject to a ± 0.5Hz change or greater (and proportionally for lower frequency changes)) as Primary, Secondary and High Frequency Response as defined in Figures CC.A3.1, CC.A3.2 and CC.A3.3 Note – Primary Response – defined as additional release of Active Power gradually increasing over the period 0 – 10 seconds and sustained for a further 20 seconds, Secondary Response – Active Power gradually released over the lessed over the less are similar to that required by the GB Grid Code. The Relevant TSO must define the Requency required by the GB Grid Code. The Relevant TSO must define the parameters for minimum frequency response capability as a percentage of Registered CCA.3.1, CCA.3.2 and CCA.3.3 Note – Primary Response – defined as additional release of Active Power gradually released over the lessed over the less achieved as achieved | | | | | | | | | | | |
| Connection Conditions (ENTSO-E Article 109 – [2 (gd)) 100 – [2 (gd) | | | | | | | | | | | |
| Conditions (ENTSO-E Article 109 – (2 (cd)) Tower frequency changes) as Primary, Secondary and High Frequency Response as defined in Figures CC.A.3.1, CC.A.3.2 and CC.A.3.3 Note – Primary Response defined as additional release of Active Power gradually increasing over the period 0 – 10 seconds and sustained for a further 20 seconds, Secondary Response – Active Power gradually released over the Power gradually released over the required by the GB Grid Code. The Relevant TSO must define the parameters for minimum frequency defined as additional release of Active Power gradually increasing over the period 0 – 10 seconds and sustained for a further 20 seconds, Secondary Response – Active Power gradually released over the required by the GB Grid Code. The Relevant TSO must define the parameters for minimum frequency defined as additional release of Active Power gradually increasing over the period 0 – 10 seconds and sustained for a further 20 seconds, Secondary Response – Active Power gradually released over the required by the GB Grid Code. The Relevant TSO must define the parameters for minimum frequency defined as additional release of Active Power gradually increasing over the period 0 – 10 seconds and sustained for a further 20 seconds, Secondary Response – Active Power gradually released over the | | | | | | | | | | | |
| (ENTSO-E Article 109 — (2 (cd)) Proportionally for lower frequency changes)) as Primary, Secondary and High Frequency Response as defined in Figures CC.A.3.1, CC.A.3.2 and CC.A.3.3 Note — Primary Response as additional release of Active Power gradually increasing over the period 0 – 10 seconds and sustained for a further 20 seconds, Secondary Response — Active Power gradually released over the period over the period 0 – 10 seconds. Secondary Response — Active Power gradually released over the released over | | | | | | | | | | | |
| Tower frequency changes) as Primary, Secondary and High Frequency Response as defined in Figures CC.A.3.1, CC.A.3.2 and CC.A.3.3, Note – Primary Response – defined as additional release of Active Power gradually increasing over the period 0 – 10 seconds and sustained for a further 20 seconds, Secondary Response – Active Power gradually released over the Power gradual prover gra | | | | | | | | | | | |
| changes)) as Primary, Secondary and High Frequency Response as defined in Figures C.C.A.3.1, C.A.3.2 and C.C.A.3.3 Note – Primary Response — defined as additional release of Active Power gradually increasing over the period 0 – 10 seconds and sustained for a further 20 seconds, Secondary Response — Active Power gradually released over the Power shall be released to the power shall b | | | | | | | | | | | |
| Primary, Secondary and High Frequency Response as defined in Figures C.C.A.3.1, C.C.A.3.2 and C.C.A.3.3 Note – Primary Response — defined as additional release of Active Power gradually increasing over the period 0 – 10 seconds and sustained for a further 20 seconds, Secondary Response — Active Power gradually released over the power shall be achieved as achieved as defined in Figures frequency response capability as a percentage of Response capability as a percentage response capability as a percentage frequency Response capability as a percentage of Response capability as a percentage frequency response capability as a percentage of Response capability as a percent | <u>109 — (2 (cd))</u> | | | | | | | | | | |
| Secondary and High Frequency Response as defined in Figures CC A.3.1, CC.A.3.2 and CC.A.3.3 Note – Primary Response – defined as additional release of Active Power gradually released over the period 0 – 10 seconds and sustained for a further 20 seconds, Secondary Response – Active Power gradually released over the period on the power gradually released over the power shall be less than gradually released over the period on the power gradually released over the power shall be achieved as | | | | | | | | | | | |
| High Frequency Response as defined in Figures CC.A.3.1, CC.A.3.2 and CC.A.3.3 Note – Primary Response – defined as additional release of Active Power gradually increasing over the period 0 – 10 seconds and sustained for a further 20 seconds, Secondary Response – Active Power gradually released over the periose – Active Power stall be Active Power gradually released over the periose – Active Power stall be Active Power gradually released over the periose – Active Power stall be Active Power stall be Active Power gradually released over the periose – Active Power stall be Active Power st | | | | | | | | | | | |
| Response as defined in Figures CC.A.3.1, CC.A.3.2 and CC.A.3.3 Note – Primary Response – defined as additional release of Active Power gradually increasing over the period 0 – 10 seconds and sustained for a further 20 secondary Response – Active Power gradually released over the Power gradually released over the power gradually released over the response - capability as a percentage of Registered Capacity (Pmax) which is between 1,152 - 10%, the Initial delay time shall be reported to 1.55 - 10%, the Initial delay time shall be reported to 1.55 - 10%, the Initial delay time shall be reported to 1.55 - 10%, the Initial delay time shall be reported to 1.55 - 10%, the Initial delay time shall be reported to 1.55 - 10%, the Initial delay time shall be reported to 1.55 - 10%, the Initial delay time shall be reported to 1.55 - 10%, the Initial delay time shall be reported to 1.55 - 10%, the Initial delay time shall be reported to 1.55 - 10%, the Initial delay time shall be reported to 1.55 - 10%, the Initial delay time shall be reported to 1.55 - 10%, the Initial delay time shall be reported to 1.55 - 10%, the Initial delay time shall be reported to 1.55 - 10%, the Initial delay time shall be reported to 1.55 - 10%, the Initial delay time shall be reported to 1.55 - 10%, the Initial delay time shall be reported to 1.55 - 10%, the Initial delay time shall be reported to 1.55 - 10%, the Initial delay time shall be repo | | | | | | | | | | | |
| defined in Figures | | | | | | | | | | | |
| CC.A.3.1, CC.A.3.2 and CC.A.3.3 Note – Primary Response – defined as additional release of Active Power gradually increasing over the period 0 – 10 seconds and sustained for a further 20 seconds, Secondary Response – Active Power gradually released over the Power gradually released over the Response – seconds, Secondary Response – Active Power gradually released over the Response – Active Power shall be released over the Response – Active Power shall be released over the Registered Capacity (Pmax) which is between 1,52 – 10%, the Initial delay time shall be less than 2 seconds: (unless justified (unless justified (unless justified (unless justified technologies with Inertial which is not reovered in the GB Code) and full delivery of Active Power shall be released over the | | | | | | | | | | | |
| CC.A.3.2 and CC.A.3.3 Note – Primary Response – defined as additional release of Active Power gradually increasing over the period 0 – 10 seconds and sustained for a further 20 seconds, Secondary Response – Active Power gradually release of Active Power a further 20 seconds and sustained for a further 20 seconds Power and a further 20 second power and a further 20 seconds Power and | | | | | | | | | | | |
| CC.A.3.3 Note – Primary Response – defined as additional release of Active Power gradually increasing over the period 0 – 10 seconds and sustained for a further 20 seconds, Secondary Response – Active Power gradually released over the Cc.A.3.3 Note – Primary Response – defined as additional release of Active Power gradually increasing over the period 0 – 10 seconds and sustained for a further 20 seconds, Secondary Response – Active Power gradually released over the Power gradually released over the Registered Capacity (Pmax) which is between liftial delay time shall be less than 2 seconds (unless justified otherwise for generation technologies with inertia(which is net covered in the GB Gede) and full delivery of Active Power gradually released over the released over the odifined as additional release of Active Power gradually increasing over the period 0 – 10 seconds (unless justified otherwise for generation technologies with inertia(which is net covered in the GB Gede) and full delivery of Active Power gradually released over the released over the | | | | | | | | | | | |
| Note – Primary Response – defined as additional release of Active Power gradually increasing over the period 0 – 10 seconds and sustained for a further 20 seconds, Secondary Response – Active Power gradually released over the Response – defined as additional release of Active Power gradually increasing over the period 0 – 10 seconds and sustained for a further 20 seconds, Secondary Response – Active Power gradually released over the Response – Active Power gradually released over the Response – Active Power gradually released over the Response – defined as additional release of Active Power gradually increasing over the period 0 – 10 seconds usustained for a further 20 seconds, Secondary Response – Active Power gradually released over the Response – Active Power gradually released over the | | | | | | | | | | | |
| Response – defined as additional release of Active Power gradually increasing over the period 0 – 10 seconds and sustained for a further 20 seconds, Secondary Response – Active Power gradually released over the Power gradually released over the r | | | | | | | | | | | |
| defined as additional release of Active Power gradually increasing over the period 0 – 10 seconds and sustained for a further 20 seconds, Secondary Response – Active Power gradually released over the Power gradually released over the Power gradually released over the period 3 – Active Power gradually increasing over the period 0 – 10 seconds and sustained for a further 20 seconds, Secondary Response – Active Power gradually released over the period 0 – Interview of Active Power gradually released over the period 0 – Interview of Active Power gradually released over the period 0 – Interview of Active Power gradually released over the period 0 – Interview of Active Power gradually released over the period 0 – Interview of Active Power gradually released over the period 0 – Interview of Active Power gradually released over the period 0 – Interview of Active Power gradually released over the period 0 – Interview of Active Power gradually released over the period 0 – Interview of Active Power gradually released over the province of Active Power gradually released over the period 0 – Interview of Active Power gradually released over the period 0 – Interview of Active Power gradually released over the period 0 – Interview of Active Power gradually released over the period 0 – Interview of Active Power gradually released over the period 0 – Interview of Active Power gradually released over the period 0 – Interview of Active Power gradually released over the period 0 – Interview of Active Power gradually released over the period 0 – Interview of Active Power gradually released over the period 0 – Interview of Active Power gradually released over the period 0 – Interview of Active Power gradually released over the period 0 – Interview of Active Power gradually released over the period 0 – Interview of Active Power gradually released over the period 0 – Interview of Active Power gradually released over the period 0 – Interview of Active Power gradually released over the period 0 – Interview of Active Power gradually relea | | | | | | | | | | | |
| additional release of Active Power gradually increasing over the period 0 – 10 seconds and sustained for a further 20 seconds, Secondary Response – Active Power gradually released over the Power gradually released over the Power gradually released over the period 0 – 10 seconds and sustained for a further 20 seconds, Secondary Response – Active Power gradually released over the released over the shall be less than 2 seconds. Initial delay time shall be less than 2 seconds. (unless justified otherwise for generation technologies with inertia(which is not eovered in the GB Code) and full delivery of Active Power gradually released over the Power shall be achieved as | | | | | | | | | | | |
| of Active Power gradually increasing over the period 0 – 10 seconds and sustained for a further 20 seconds, Secondary Response – Active Power gradually released over the power gradually released over the period 0 – 10 seconds and sustained for a further 20 seconds, Secondary Response – Active Power gradually released over the released | | | | | | | | | | | |
| gradually increasing over the period 0 – 10 seconds and sustained for a further 20 seconds, Secondary Response – Active Power gradually released over the power of the power of the period 0 – 10 seconds and sustained for a further 20 seconds, Secondary Response – Active Power gradually released over the released over | | | | | | | | | | | |
| increasing over the period 0 – 10 seconds and sustained for a further 20 seconds, Secondary Response – Active Power gradually released over the | | | | | | | | | | | |
| the period 0 – 10 seconds and sustained for a further 20 seconds, Secondary Response – Active Power gradually released over the the period 0 – 10 seconds and sustained for a further 20 seconds, Secondary Response – Active Power gradually released over the the period 0 – 10 seconds and sustained for a further 20 inertia(which is not ecovered in the GB Code) and full delivery of Active Power shall be achieved as | | | | | | | | | | | Formatted: Highlight |
| seconds and sustained for a further 20 further 20 seconds, Secondary Response – Active Power gradually released over the seconds over the seco | | | | | | | | | | | |
| sustained for a further 20 seconds, Secondary Response – Active Power gradually released over the seconds sustained for a further 20 seconds, Secondary Response – Active Power gradually released over the seconds sustained for a further 20 seconds, Secondary Code) and full delivery of Active Power shall be achieved as | | | | | | | | | | | |
| further 20 seconds, Seconds, Secondary Response – Active Power gradually released over the seconds of the seconds seconds, Secondary Ruther 20 seconds, Secondary Secondary Secondary Response – Active Power gradually released over the seconds seconds, Secondary Secondary Gode) and full delivery of Active Power gradually released over the seconds seconds, Secondary Gode) and full delivery of Active Power shall be achieved as | | | | | | | | | | | |
| seconds, Secondary Response – Active Power gradually released over the seconds, Secondary Response – Active Power gradually released over the seconds, Seconds, Secondary Response – Active Power gradually released over the seconds, Seconds, Seconds, Secondary Response – Active Power gradually released over the seconds, Secondary Response – Active Power shall be achieved as | | | | | | | | | | | |
| Secondary Response – Active Power gradually released over the Response – Active Power shall be achieved as | | | | | | | | | | | |
| Response – Active Power gradually released over the Response – Active Power gradually released over the Response – Active Power shall be achieved as | | | | | | | | | | | |
| Power gradually released over the released over | | | | | | | | | | | |
| released over the released over the achieved as | | | | | | | | | | | |
| 10.00.000 070. 0.0 | | | | | | | | | | | |
| period 0 – 30 | | | | | | | | specified by the | | | |
| seconds and seconds are seconds and seconds and seconds are seconds and seconds and seconds are seconds and seconds are seconds and seconds are seconds and seconds are seconds as seconds are second | | | | | | | | | | | |

| | | | TABLE | E 2 – GB Grid Co | de Comparison t | to ENTSO-E Rf | G | | |
|-------------|-------|-----|--------------------------|------------------------|-----------------|------------------|--------------------------------------|--------------------|----------------------|
| Requirement | Plant | Key | GB | Power Station T | уре | E | NTSO-E RfG- Ge | nerating Unit Ty | ре |
| • | Type | 2 | Large | Medium | Small | D | C | B | A |
| | | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW_(GB) | 1 – 10 MW_(GB) | <u>8</u> 400W – 1 MW |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected |
| | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV |
| | | | (SHETL) | | | and subject to | subject to Article | subject to Article | |
| | | | | | | Article 4(3) and | 4(3) and Article 3 | 4(3) and Article 3 | |
| | | | | | | Article 6 (d) | <u>(6) (c)</u> | <u>(6) (b)</u> | |
| | | | sustained for a | sustained for a | | | shall be less than | | |
| | | | further 30 minutes | further 30 minutes | | | 30 seconds | | |
| | | | and High Frequency | and High Frequency | | | (unless longer times are admitted | | |
| | | | Response is the | Response is the | | | by the Relevant | | |
| | | | reduction in Active | reduction in Active | | | TSO due to | | |
| | | | Power to a | Power to a | | | System Stability | | |
| | | | frequency rise | frequency rise | | | reasons. Power | | |
| | | | which must be | which must be | | | Generating | | |
| | | | achievable within | achievable within | | | <u>Module</u> Units | | |
| | | | 10 seconds and | 10 seconds and | | | shallto be capable | | |
| | | | sustainable | sustainable | | | of providing full | | |
| | | | thereafter. | thereafter. | | | Active Power | | |
| | | | (NIatawalia da Ia | | | | Frequency | | |
| | | | (Not applicable to | | | | Response (to be | | |
| | | | Power Park Modules in | | | | specified) by the TSO for a period | | |
| | | | Scotland which | | | | of between 15 | | |
| | | | have a Registered | | | | minutes and 30 | | |
| | | | Capacity of less | | | | minutes and | | |
| | | | than 50MW) | | | | Generators must | | |
| | | | | | | | operate between | | |
| | | | | | | | their maximum | | |
| | | | | | | | and | | |
| | | | | | | | minimumActive | | |
| | | | | | | | Power headroom | | |
| | | | | | | | and Primary | | |
| | | | | | | | Energy Source | | |
| | | | | | | | See Article <u>109</u> – | | |
| | | | | | | | 2 <u>(cd)(56)(6) and</u> | | |
| | | | | | | | (7) including Figure 6 and | | |
| | | | | | | | Table 5. | | |

| | | | TABLE | 2 – GB Grid C | ode Comparison | to ENTSO-E Rf | G | | |
|---|--|-----|---|------------------------------------|---|--|---|--|--|
| Requirement | Plant | Key | GB | Power Station | Туре | E | NTSO-E RfG- Ge | nerating Unit Ty | ре |
| | Type | 2 | Large | Medium | Small | D | C | B | . A |
| | | | > 100 MW (E&W) > 30 MW (SPT) > 10 MW (SHETL) | 50 – 100MW N/A (SPT / SHETL) | < 50MW < 30MW (SPT) < 10 MW (SHETL) | > 30MW or connected at 110kV or above and subject to Article 4(3) and Article 6 (d) | 30 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (c) | 1 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) | 8400W – 1 MW and connected below 110kV |
| Synchronous Generating Unit Excitation System Requirements GB CC.6.3.8(a)(i) ENTSO-E Article 121 – 2(b) | Synchronous (Not applicable to Asynchronous Plant) | 5 | Required to have a continuously acting automatic excitation control system to provide constant terminal voltage of the Synchronous Generating Unit without instability over the entire operating range | As per Large | N/A | As per Type B | As per Type B | Required to have 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 ModuleUnit as per Article 124 – 2(b). | N/S |
| Synchronous Generating Unit Excitation System Performance Requirements GB CC.6.3.8(a)(ii) and Appendix 6 of the Connection Conditions (ENTSO-E Article 12-1-2(b), Article 12-3(a)(5) and Article 134 - (2) and Article 14 - (3)b) (c), (d), (e), (f), (g) and (h) | Synchronous (Not applicable to Asynchronous Plant) | 9 | Either specified in the Bilateral Agreement if historical plant or detailed in Appendix 6 of the Connection Conditions if the Connection date is after 1 January 2009. In general the following high level requirements apply, i) The Excitation System shall comprise of an | As per Large | N/A | In addition to the requirements of Type B-and Type C (as appropriate) the following requirements apply as specified in Article 143 – (2) and (3) b), (c), (d), (e), (f), (g) and (h). In general the following high level requirements apply which | None other than in respect of the requirements of Type B. The Relevant Network Operator will specify what additional facilities are installed on the Synchronous Power Generating Facility in order to carry out voltage and Reactive Power control within its area as detailed in Article 12—3(a)(5) | Not specified other than in respect of the requirement to have a automatic excitation control system as detailed in Article 124-2(b) as noted above | N/S |

| > 30 MW (SPT) N/A (SPT / < 30MW (SPT) connected at <u>and connected</u> <u>and connected</u> <u>and connected</u> <u>and connected</u> | TABLE 2 – GB Grid Code Comparison to ENTSO-E RfG | | | | | | | | | | |
|--|--|-------|-----|-----------------------|------------|-----------------|-----------------------------------|-----------------|----------------|----------------------|--|
| Type 2 Large Medium Small D C B A A SOMW (SPT) > 100 MW (SPT) > 1 | Requirement | Plant | Key | GB Power Station Type | | | ENTSO-E RfG Generating Unit Type | | | | |
| > 30 MW (SPT) | · | Type | | Large | Medium | Small | | | | _ | |
| SHETL | | | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW_(GB) | 1 – 10 MW (GB) | <u>8</u> 400W – 1 MW | |
| (SHETL) and subject to Article 4(3) and Article 6 (d) Afticle 6 (d) (d) and Article 6 (d) (d) (d) and Article 6 (d) (d) (d) (d) (d) (d) (d) (e) (d) (e) (d) (e) (d) (e) (e) (e) (e) (e) (e) (e) (e) (e) (e | | | | | | | | | | and connected | |
| Article 4(3) and Article 3 (6) (c) Excitation Source, Power System Stabiliser and Automatic Voltage Regulator ii) Steady State Voltage Control to limit the change in terminal voltage from no load to full load iii) Transient Voltage Control to Performance when on open circuit with performance requirements to achieve 100% voltage being achieved within less than 0.6 seconds and the time to settle within 5% of the voltage Control seconds. iv) Performance requirements for the seconds. iv) Performance th | | | | | SHETL) | < 10 MW (SHETL) | | | | below 110kV | |
| Excitation Source, Power System Stabiliser and Automatic Voltage Regulator ii) Steady State Voltage Control to limit the change in terminal voltage from no load to full load iii) Transient Voltage Control to Performance when on open circuit with performance requirements to achieve within a scenario and the time to eattle within 5% of the voltage being achieved within less than 0.6 seconds and the time to settle within 5% of the voltage change achieved within seconds. I Excitation Source, power System shall be addreed to the voltage control system shall be agreed between the Generator and Relevant Network Operator in co-cordination with the Relevant TSO. These shall be sourced to within 15% of the voltage control to thim to settle within 5% of the voltage change achieved within seconds. I So These shall include: Steady State Voltage Control to thim the cettle within 5% of the voltage change achieved within 3 seconds. I we remaind voltage from no load to the form no load to the Exciter rise the Exciter rise the Relevant to the Relevant to the Relevant to the Exciter rise the Relevant the Relevant to the Relevant the Relev | | | | (SHETL) | | | | | | | |
| Excitation Source, Power System Stabiliser and Automatic Voltage Regulator ii) Steady State Voltage Control to limit the change in terminal voltage from no load to full load iii) Transient Voltage Control Performance when on open circuit with performance requirements to achieve 100% voltage being achieved within less than 0.6 seconds and the time to settle within 5% of the voltage control settle within 5% of the voltage change achieved within seconds. iii) Performance requirements to achieve difficulties the voltage control settle within 5% of the voltage change achieved within seconds. iv) Performance requirements for the Exciter rise Time will be the Relevant to requirements to achieve difficulties state voltage change achieved within seconds. iv) Performance requirements for the Exciter rise Time will be the Relevant to full lead the parameters being defined by the Relevant to full lead the parameters being defined by the Relevant the Relevant to full lead the parameters being defined by the Relevant the Relevant the Relevant to full lead the parameters being defined by the Relevant the Relevant the Relevant the Relevant to full lead the parameters being defined by the Relevant the Relevan | | | | | | | | | | | |
| Power System Stabiliser and Automatic Voltage Regulator ii) Steady State Voltage Control to limit the change in terminal voltage from no load to full load iii) Transient Voltage Control Performance when on open circuit with performance requirements to achieve 100% voltage being achieved within less than 0.6 seconds and the time to settle within 5% of the voltage control to achieved within 3 seconds. ii) Transient Voltage Control Performance requirements to achieved within 3 seconds. iii) Tensient Voltage Control Performance requirements to achieve 100% voltage being achieved within less than 0.6 seconds and the time to settle within 5% of the voltage change achieved within 3 seconds. iv) Performance requirements for the Exciter rise Time will be the Relevant terminal voltage term no load to full load parameters and para | | | | Evoitation Course | | | | | <u>(d) (d)</u> | | |
| Stabiliser and Automatic Voltage Regulator ii) Steady State Voltage Control to limit the change in terminal voltage from no load to full load iii) Transient Voltage Control | | | | | | | | | | | |
| Automatic Voltage Regulator ii) Steady State Voltage Control to limit the change in terminal voltage from no load to full load iii) Transient Voltage Control Voltage Control Performance when on open circuit with performance requirements to achieve 100% voltage being achieved within less than 0.6 seconds and the time to settle within 5% of the voltage Control time to settle within 5% of the voltage Control system shall be agreed between the Generator and Relevant Network Operator in co- ordination with the Relevant TSO. These shall include: steady State Voltage Control the Relevant TSO. These shall include: steady State Voltage Control time to settle within 5% of the voltage Control time to settle within 5% of the voltage Control to achieved within 3 seconds. iv) Performance requirements for the Exciter rise Time will be the Relevant Time will be the Relevant TSO. These shall include: steady State Voltage-Control to limit the change in terminal voltage from no load to full load the parameters being defined by the Relevant | | | | | | | | 4(0). | | | |
| Regulator ii) Steady State Voltage Control to limit the change in terminal voltage from no load to full load iii) Transient Voltage Control Performance when on open circuit with performance requirements to achieve 100% voltage being achieved within less than 0.6 seconds and the time to settle within 5% of the voltage Control seconds. ii) Preformance requirements for time to settle within 5% of the voltage change achieved within 3 seconds. iv) Performance requirements for the Exciter rise Time will be the Relevant lihe parameters being achieved within 3 seconds. iv) Performance requirements for the Exciter rise Time will be the Relevant the parameters being defined by the Relevant the time to settle voltage Control to limit the change in terminal voltage from no load to full-load the parameters being defined by the Relevant | | | | | | | | | | | |
| ii) Steady State Voltage Control to limit the change in terminal voltage from no load to full load iii) Transient Voltage Control Performance when on open circuit with performance requirements to achieve 100% voltage being achieved within less than 0.6 seconds and the time to settle within 5% of the voltage control seconds. iv) Performance requirements for the Exciter rise Time will be image and setting and seconds. iv) Performance requirements for the Exciter rise Time will be image and setting and set | | | | | | | (-) | | | | |
| limit the change in terminal voltage from no load to full load iii) Transient Voltage Control Performance when on open circuit with performance requirements to achieve 100% voltage being achieved within less than 0.6 seconds and the time to settle within 5% of the voltage control settle within 5% of the voltage change achieved within 3 seconds. ii) Performance the full | | | | ii) Steady State | | | i)- The | | | | |
| terminal voltage from no load to full load iii) Transient Voltage Control system shall be agreed between the Performance when on open circuit with performance requirements to achieve 100% voltage being achieved within less than 0.6 seconds and the time to settle within 5% of the voltage be dange achieved within 3 seconds. iii) Performance requirements to achieved within 5% of the voltage being achieved within 5% of the voltage change achieved within 3 seconds. iv) Performance requirements for the Exciter rise Time will be components of the voltage control system shall be agreed between the Senerator and Relevant Network Operator in co- ordination with the Relevant TSO. These shall include: Steady State Veltage Control to limit the change in terminal voltage from no load to full load the parameters being defined by the Relevant | | | | | | | | | | | |
| from no load to full load iii) Transient Voltage Control Performance when on open circuit with performance requirements to achieve 100% voltage being achieved within less than 0.6 seconds and the time to settle within 5% of the voltage change achieved within 3 seconds. iv) Performance requirements to the time to settle within 5% of the voltage change achieved within 3 seconds. iv) Performance requirements for the Exciter rise Time will be Intervoltage control to between the Generator and Relevant Network Operator in co-ordination with the Relevant TSO. These shall include:-Steady-State Voltage Control to limit the change in terminal voltage from no load to full load the parameters being defined by the Relevant | | | | | | | | | | | |
| load iii) Transient Voltage Control Performance when on open circuit with performance requirements to achieve 100% voltage being achieved within less than 0.6. seconds and the time to settle within 5% of the voltage change achieved within 3 seconds. iv) Performance requirements for the Exciter rise Time will be control system shall be agreed between the Generator and Relevant Network Operator in co- ordination with TSO. These shall include: Steady State Voltage Control to limit the voltage Control to limit the change in terminal voltage from no load te full load the parameters being defined by the Relevant | | | | | | | | | | | |
| iii) Transient Voltage Control Performance when on open circuit with performance requirements to achieve 100% voltage being achieved within less than 0.6 seconds and the time to settle within 5% of the voltage change achieved within 3 seconds. iv) Performance requirements for the Exciter rise Time will be shall be agreed between the between the Generator and Relevant Network Operator in co- ordination with the Relevant TSO. These shall include: Steady State Voltage Control to limit the change in terminal voltage from no load-to full load the parameters being defined by the Relevant | | | | | | | | | | | |
| Voltage Control Performance when on open circuit with performance requirements to achieve 100% voltage being achieved within less than 0.6 seconds and the time to settle within 5% of the voltage change achieved within 3 seconds. iv) Performance requirements for the Exciter rise Time will be Voltage Control to limit the Generator and Relevant Network Operator in co- ordination with the Relevant TSO. These shall include:- Steady State Veltage Control to limit the change in terminal voltage from no load to full load the parameters being defined by the Relevant | | | | | | | chall be agreed | | | | |
| Performance when on open circuit with performance requirements to achieve 100% voltage being achieved within less than 0.6 seconds and the time to settle within 5% of the voltage change achieved within 3 seconds. iv) Performance requirements for the Exciter rise Time will be | | | | | | | | | | | |
| on open circuit with performance requirements to achieve 100% voltage being achieved within less than 0.6 seconds and the time to settle within 5% of the voltage change achieved within 3 seconds. iv) Performance requirements for the Exciter rise Time will be Relevant Network Operator in co- ordination with the Relevant TSO. These shall include:- Steady State Voltage Control to limit the change in terminal voltage from no load to full load the parameters being defined by the Relevant | | | | | | | | | | | |
| requirements to achieve 100% voltage being achieved within less than 0.6 seconds and the time to settle within 5% of the voltage change achieved within 3 seconds. iv) Performance requirements for the Exciter rise Time will be requirements to achieved in coordination with the Relevant TSO. These shall include: Steady State Voltage Control to limit the change in terminal voltage from no load to full load the parameters being defined by the Relevant the Rel | | | | | | | | | | | |
| achieve 100% voltage being achieved within less than 0.6 seconds and the time to settle within 5% of the voltage change achieved within 3 seconds. iv) Performance requirements for the Exciter rise Time will be | | | | with performance | | | Network | | | | |
| voltage being achieved within less than 0.6 seconds and the time to settle within 5% of the voltage change achieved within 3 seconds. iv) Performance requirements for the Exciter rise Time will be | | | | | | | | | | | |
| achieved within less than 0.6 seconds and the time to settle within 5% of the voltage change achieved within 3 seconds. iv) Performance requirements for the Exciter rise TSO. These shall include:- Steady State Voltage Control to limit the change in terminal voltage from no load to full load the parameters being defined by the Relevant | | | | | | | | | | | |
| less than 0.6 seconds and the time to settle within 5% of the voltage change achieved within 3 seconds. iv) Performance requirements for the Exciter rise Time will be | | | | | | | | | | | |
| seconds and the time to settle within 5% of the voltage change achieved within 3 seconds. iv) Performance requirements for the Exciter rise Time will be | | | | | | | | | | | |
| time to settle within 5% of the voltage change achieved within 3 seconds. iv) Performance requirements for the Exciter rise Time will be Voltage Control to limit the change in terminal voltage from no load to full load the parameters being defined by the Relevant | | | | | | | | | | | |
| within 5% of the voltage change achieved within 3 seconds. iv) Performance requirements for the Exciter rise Time will be to limit the change in terminal voltage from no load to full load the parameters being defined by the Relevant | | | | | | | | | | | |
| voltage change achieved within 3 seconds. iv) Performance requirements for the Exciter rise Time will be change in terminal voltage from no load to full load the parameters being defined by the Pelevant | | | | | | | | | | | |
| achieved within 3 seconds. iv) Performance requirements for the Exciter rise Time will be terminal voltage from no load to full load the parameters being defined by the Relevant | | | | | | | | | | | |
| iv) Performance requirements for the Exciter rise Time will be full lead the parameters being defined by the Relevant | | | | | | | | | | | |
| requirements for the Exciter rise Time will be Time willi | | | | | | | | | | | |
| the Exciter rise Time will be the Exciter rise the Excit | | | | | | | | | | | |
| Time will be the Pelevant | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| TSO but shall | | | | | | | | | | | |
| generally be ii) Specifications | | | | | | | | | | | |

| | | TABLE | de Comparison | on to ENTSO-E RfG | | | | |
|-------------------|-----|---|------------------------------------|---|---|--|---|--|
| Requirement Plant | Key | GB | Power Station 1 | ype | Е | NTSO-E RfG- Ge | nerating Unit Ty | ре |
| . Type | | Large | Medium | Small | D | C | B | A |
| | | > 100 MW (E&W) > 30 MW (SPT) > 10 MW (SHETL) | 50 – 100MW N/A (SPT / SHETL) | < 50MW < 30MW (SPT) < 10 MW (SHETL) | > 30MW or connected at 110kV or above and subject to Article 4(3) and Article 6 (d) | 30 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (c) | 1 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) | 8400W – 1 MW and connected below 110kV |
| | | between 50ms and 300ms. v) Requirements for Excitation System on load Positive Ceiling Voltage will be specified by NGET but will generally be between 2 p.u and 4 p.u or Rated field voltage vi) Requirements for a negative ceiling voltage of 80% of the positive ceiling voltage if a static exciter is employed vii) Maintenance of free firing when the Generator terminals are exposed to a drop of between 20 – 30% of rated terminal voltage viii) The Excitation System (if static) should obtain a positive on load ceiling voltage of not less than 80% | | | and performance of the AVR including steady state and transient voltage control. Transient Voltage Control Performance when on open circuit with performance requirements for the time to achieve 100% voltage and the time to settle within 5% of the voltage change being specified by the Relevant Netwerk Operator. iii) Specifications and performance of the Excitation System including bandwidth limitations to prevent torsional oscillations to other Users | | 357.154 | |

| Requirement | Plant | Key | | Power Station | ode Comparison | | NTSO-E RfG- Ge | nerating Unit Tv | pe |
|-------------|-------|-----|--------------------------------------|---------------|-----------------|---|--------------------|--------------------|---------------|
| | Туре | 2 | Large | Medium | Small | D | C | B | A |
| | 7. | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW (GB) | 1 – 10 MW (GB) | 8400W - 1 MW |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected |
| | | | > 10 MW ` ′ | SHÈTL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV |
| | | | (SHETL) | , | , , | and subject to | subject to Article | subject to Article | |
| | | | | | | Article 4(3) and | 4(3) and Article 3 | 4(3) and Article 3 | |
| | | | | | | Article 6 (d) | (6) (c) | <u>(6) (b)</u> | |
| | | | upon recovery of | | | Plant | | | |
| | | | the Generating | | | Requirements | | | |
| | | | Unit following fault clearance. | | | for Excitation System on load | | | |
| | | | ix) The overall | | | Positive Ceiling | | | |
| | | | Excitation Control | | | Voltage will be | | | |
| | | | System shall limit | | | specified by the | | | |
| | | | the bandwidth of | | | Relevant | | | |
| | | | the output signal | | | Network | | | |
| | | | so as not to cause | | | Operator | | | |
| | | | torsional | | | iv) Under and | | | |
| | | | oscillations on | | | Over Excitation | | | |
| | | | other plant | | | <u>Limiters</u> | | | |
| | | | connected to the | | | Requirements | | | |
| | | | network. | | | for a negative | | | |
| | | | x) The Excitation | | | ceiling voltage if | | | |
| | | | System shall be | | | a static exciter is employed will be | | | |
| | | | equipped with an Under Excitation | | | specified by the | | | |
| | | | Limiter | | | Relevant | | | |
| | | | xi) The Excitation | | | Network | | | |
| | | | System shall be | | | Operator | | | |
| | | | equipped with an | | | v) Stator Current | | | |
| | | | Over Excitation | | | limiter Maintenan | | | |
| | | | Limiter. | | | ce of free firing | | | |
| | | | | | | when the | | | |
| | | | | | | Generator | | | |
| | | | | | | terminals are | | | |
| | | | | | | exposed to a | | | |
| | | | | | | drop of 25% of | | | |
| | | | | | | rated terminal | | | |
| | | | | | | voltage | | | |
| | | | | | | vi) <u>Power</u> | | | |
| | | 1 | | | | <u>System</u> | 1 | 1 | I |

Formatted: Norwegian (Bokmål)

| Requirement | Plant | Key | GBI | Power Station | Type | Е | NTSO-E RfG- Ge | nerating Unit Ty | pe |
|-------------|-------|-----|----------------|---------------|-----------------|-----------------------|--------------------|--------------------|-----------------------|
| | Туре | 2 | Large | Medium | Small | D | C | В | A |
| | | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW (GB) | 1 – 10 MW_(GB) | <u>8</u> 400W – 1 MW |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected |
| | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV |
| | | | (SHETL) | J , | (0.12.2) | and subject to | subject to Article | subject to Article | <u>50.011 1.10111</u> |
| | | | (011212) | | | Article 4(3) and | 4(3) and Article 3 | 4(3) and Article 3 | |
| | | | | | | Article 6 (d) | (6) (c) | (6) (b) | |
| | | | | | | Stabiliser | , , , , , , | 127,127 | |
| | | | | | | requirements as | | | |
| | | | | | | defined by the | | | |
| | | | | | | Relevant TSO | | | |
| | | | | | | while respecting | | | |
| | | | | | | the provisions of | | | |
| | | | | | | Article 4(3) The | | | |
| | | | | | | Excitation | | | |
| | | | | | | System (if static) | | | |
| | | | | | | should obtain a | | | |
| | | | | | | positive on load | | | |
| | | | | | | ceiling voltage of | | | |
| | | | | | | not less than | | | |
| | | | | | | 80% upon | | | |
| | | | | | | recovery of the | | | |
| | | | | | | Generating Unit | | | |
| | | | | | | following fault | | | |
| | | | | | | clearance. | | | |
| | | | | | | vii) <u>The Power</u> | | | |
| | | | | | | <u>Generating</u> | | | |
| | | | | | | Facility shall | | | |
| | | | | | | also satisfy | | | |
| | | | | | | <u>appropriate</u> | | | |
| | | | | | | <u>robustness</u> | | | |
| | | | | | | criteria to aid | | | |
| | | | | | | angular stability | | | |
| | | | | | | under fault | | | |
| | | | | | | conditions such | | | |
| | | | | | | as fast valving or | | | |
| | | | | | | <u>breaking</u> | | | |
| | | | | | | resistors as | | | |
| | | | | | | requested by the | | | |
| | | | | | | Relevant TSO | | | |
| | | | | | | whilst respecting | | | |

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| | | 1.0 | | | • | on to ENTSO-E RfG | | | | |
|-------------|-------|-----|----------------|---------------|-----------------|------------------------------|--------------------|--------------------|----------------------|--|
| Requirement | Plant | Key | GB | Power Station | | | NTSO-E RfG- Ge | | pe | |
| | Type | 2 | Large Large | Medium | Small | D | C | B | .A | |
| | | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW (GB) | 1 – 10 MW (GB) | <u>8</u> 400W - 1 MW | |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected | |
| | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV | |
| | | | (SHETL) | | , , | and subject to | subject to Article | subject to Article | | |
| | | | | | | Article 4(3) and | 4(3) and Article 3 | 4(3) and Article 3 | | |
| | | | | | | Article 6 (d) | (6) (c) | <u>(6) (b)</u> | | |
| | | | | | | the provisions of | | | | |
| | | | | | | Article 4(3). The | | | | |
| | | | | | | overall | | | | |
| | | | | | | Excitation | | | | |
| | | | | | | Control System | | | | |
| | | | | | | shall limit the | | | | |
| | | | | | | bandwidth of the | | | | |
| | | | | | | output signal so | | | | |
| | | | | | | as not to cause | | | | |
| | | | | | | torsional | | | | |
| | | | | | | oscillations on | | | | |
| | | | | | | other plant connected to the | | | | |
| | | | | | | network. The | | | | |
| | | | | | | Bandwidth shall | | | | |
| | | | | | | be limited to 3Hz | | | | |
| | | | | | | unless otherwise | | | | |
| | | | | | | specified by the | | | | |
| | | | | | | TSO. | | | | |
| | | | | | | viii) The | | | | |
| | | | | | | Excitation | | | | |
| | | | | | | System shall be | | | | |
| | | | | | | equipped with | | | | |
| | | | | | | an Under | | | | |
| | | | | | | Excitation | | | | |
| | | | | | | Limiter | | | | |
| | | | | | | ix) The | | | | |
| | | | | | | Excitation | | | | |
| | | | | | | System shall be | | | | |
| | | | | | | equipped with | | | | |
| | | | | | | an Over | | | | |
| | | | | | | Excitation | | | | |
| | | | | | | Limiter | | | | |
| | | | 1 | | | x) Co-ordination | 1 | | | |

| TABLE 2 – GB Grid Code Comparison to ENTSO-E RfG | | | | | | | | | |
|---|--|----------|--|------------------------------------|---|---|---|--|--|
| Requirement | Plant | Key | GB | Power Station T | уре | Е | NTSO-E RfG- Ge | enerating Unit Ty | ре |
| | Type | 2 | Large | Medium | Small | D | C | B | A |
| | | | > 100 MW (E&W) > 30 MW (SPT) > 10 MW (SHETL) | 50 – 100MW N/A (SPT / SHETL) | < 50MW < 30MW (SPT) < 10 MW (SHETL) | > 30MW or connected at 110kV or above and subject to Article 4(3) and Article 6 (d) | 30 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (c) | 1 – 10 MW (GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) | 8400W – 1 MW and connected below 110kV |
| Power Park Module Voltage Control Requirements GB – CC.6.3.8(a)(iii) Article 154 -21(a) and Article 16 – (3) (de) | Asynchronous (Not applicable to Synchronous Plant) | <u>5</u> | Each Power Park Module is required to have a continuously acting automatic control system to control the voltage at the Connection Point without instability over the entire operating range of the Power Park Module. Any Plant or Apparatus used in the provisions of such voltage control may be located at the Power Park Unit | As per Large | N/A | is required between the Stator Current Limiter and Overexcitation Limiter xi) The Excitation System shall include a Power System Stabiliser if specified by the Relevant TSO. As per Type C | The Power Park Module shall be capable of providing Reactive Power automatically by operation in either Voltage Control mode, Reactive Power Control Mode or Power Factor Control Mode or by a combination of two of these as defined in Article 16 – (3) (de). | The Relevant Network Operator has the right to define the capability of a Power Park Module whilst respecting the provisions of Article 4(3) as defined in Article 15 – 2(a) As per type A | N/SPower Park Modules are only required to have a Reactive Power Capability at the high voltage terminals of the step up transformer to the voltage level of the Connection Point or at the alternator terminals, if no step up transformer exists as defined by the Relevant DSO as defined |

| | | | TABLE | 2 – GB Grid Co | de Comparison | on to ENTSO-E RfG | | | | |
|---|--|-----|--|------------------------------------|---|--|--|--|---|--|
| Requirement | Plant | Key | GB | Power Station 1 | уре | E | NTSO-E RfG- Ge | enerating Unit Ty | rpe | |
| - | Type | 2 | Large | Medium | Small | D | C | B | | |
| | | | > 100 MW (E&W) > 30 MW (SPT) > 10 MW (SHETL) | 50 – 100MW N/A (SPT / SHETL) | < 50MW < 30MW (SPT) < 10 MW (SHETL) | > 30MW or connected at 110kV or above and subject to Article 4(3) and Article 6 (d) | 30 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (c) | 1 – 10 MW (GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) | 8400W – 1 MW and connected below 110kV | |
| | | | Terminals, an intermediate bus bar of the Connection Point | | | | | | in Article 14 -1(a) pursuant to Article 4(3). | |
| Power Park Module Voltage Control Performance Requirements GB — CC.6.3.8(a)(iv) and Appendix 7 of the Connection Conditions (ENTSO-E Article 154 -24(a) and Article 16 — (3) (de) and (f) | Asynchronous (Not applicable to Synchronous Plant) | 9 | Either specified in the Bilateral Agreement if historical plant or detailed in Appendix 7 of the Connection Conditions if the Connection date is after 1 January 2009. In general the following high level requirements apply: i) Continuous steady state voltage control is required at the Connection Point with a setpoint voltage and slope characteristic as shown in Figure CC.A.7.2.2(a) ii) The control system shall be capable of operating to a setpoint voltage of | As per Large | N/A | As per Type C | In addition to the requirements of Type BA (as appropriate) the following requirements apply as specified in Article 16 – 3) (de) and (f). In general the following high level requirements apply:- i) For the purposes of providing Voltage Control the Power Park Module shall be capable of contributing to voltage control at the Connection Point by provision of Reactive Power exchange with the NetworkSystem with a setpoint voltage covering at least 0.95 to | The Relevant Network Operator has the right to define the capability of a Power Park Module whilst respecting the provisions of Article 4(3) as defined in Article 15 – 2(a) As per Type A | N/S Power Park Modules are only required to have a Reactive Power Capability as defined by the Relevant DSO as defined in Article 14 - 1(a) and pursuant to Article 4(3). | |

| | | | TABLE | 2 – GB Grid C | ode Comparison t | on to ENTSO-E RfG | | | | |
|-------------|-------|-----|-------------------------------------|---------------|------------------|-------------------|----------------------------|--------------------|---------------|--|
| Requirement | Plant | Key | GB | Power Station | Туре | Е | NTSO-E RfG- Ge | nerating Unit Ty | pe | |
| | Type | 2 | Large Large | Medium | Small | D | C | B | A | |
| | | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW (GB) | 1 – 10 MW (GB) | 8400W - 1 MW | |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected | |
| | | | > 10 MW ` ′ | SHÈTL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV | |
| | | | (SHETL) | , | , | and subject to | subject to Article | subject to Article | | |
| | | | ` | | | Article 4(3) and | 4(3) and Article 3 | 4(3) and Article 3 | | |
| | | | | | | Article 6 (d) | (6) (c) | (6) (b) | | |
| | | | between 95% and | | | | 1.05 p.u in steps | | | |
| | | | 105% with a | | | | no greater than | | | |
| | | | resolution of | | | | 0.01p.u with a | | | |
| | | | 0.25%. | | | | Slope with a range | | | |
| | | | iii) The initial | | | | of at least 2-7% in | | | |
| | | | setpoint voltage | | | | steps no greater | | | |
| | | | will be 100% but | | | | than 0.5%. The | | | |
| | | | NGET may specify | | | | Reactive Power | | | |
| | | | and alternative | | | | output shall be | | | |
| | | | setpoint voltage | | | | zero when the | | | |
| | | | within the range of | | | | Grid voltage value | | | |
| | | | 95% to 105%. | | | | at the Connection | | | |
| | | | iv) The setpoint | | | | Point equals the | | | |
| | | | voltage should be | | | | voltage setpoint. | | | |
| | | | adjustable | | | | The setpoint may | | | |
| | | | between 95% and | | | | be operated with | | | |
| | | | 105% to a | | | | or without a | | | |
| | | | tolerance of 0.25% | | | | deadband | | | |
| | | | (ie 95%, 95.25%, | | | | selectable in a | | | |
| ıl l | | | 95.5%) | | | | range from 0 to | | | |
| 4 | | | v) The Slope setting should also | | | | ±+510% of nominal network | | | |
| | | | be adjustable with | | | | voltage in steps no | | | |
| | | | a range of | | | | greater than 0.5%. | | | |
| | | | between 2 and 7% | | | | ii) Following a step | | | |
| | | | with a resolution of | | | | change in voltage. | | | |
| | | | 0.5% (ie slope | | | | the Power Park | | | |
| | | | settings of 2, 2.5, | | | | Module shall be | | | |
| | | | 3.5 % may be | | | | capable of | | | |
| | | | specified. | | | | achieving 90% of | | | |
| ' | | | vi) The Voltage | | | | the change in | | | |
| | | | control System | | | | Reactive Power | | | |
| | | | should have a | | | | output shall be | | | |
| | | | steady state | | | | achieved within a | | | |

| | | | TABLE | ode Comparison | on to ENTSO-E RfG | | | | |
|-------------|-------|-----|--|------------------------------------|---|--|--|---|--|
| Requirement | Plant | Key | GB | Power Station | Туре | E | NTSO-E RfG- Ge | nerating Unit Ty | ре |
| [| Type | 2 | Large | Medium | Small | D | C | B | A |
| | | | > 100 MW (E&W) > 30 MW (SPT) > 10 MW (SHETL) | 50 – 100MW N/A (SPT / SHETL) | < 50MW < 30MW (SPT) < 10 MW (SHETL) | > 30MW or connected at 110kV or above and subject to Article 4(3) and Article 6 (d) | 30 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (c) | 1 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) | 8400W – 1 MW and connected below 110kV |
| | | | operating range over a range of setpoint voltages (95% - 105%) and slopes 2-7% as detailed in Figures CC.A.7.2.2b and CC.a.7.2.2c (in the case of 33kV Connections or below) of Appendix 7 of the Connection Conditions. vii) If the operating point of the Power Park Module deviate so that it is no longer on the operating characteristic defined by the setpoint voltage and slope the control system shall act progressively to return the value to a point on the required characteristic within 5 seconds viii) The automatic control system | | | | time specified by the Relevant Network Operator (whilst respecting the provisions of Article 4(3))‡ in the range of 1 – 5 seconds - second and settle at the value defined by the operating slope within a time to be specified by the Relevant Network Operator whilst respecting the provisions of Article 4(3) in the range 5 – 60 seconds 5 seconds with a steady state reactive tolerance no greater than 5% of the maximum Reactive Power. iii) For Reactive Power Park Module shall be capable of setting the Reactive Power of the power Park Module Seconds of Setting the Reactive Power Po | | |

| | | | TABLE | 2 – GB Grid C | ode Comparison t | on to ENTSO-E RfG | | | | |
|-------------|-------|-----|----------------------------------|---------------|------------------|-------------------|--------------------------------------|--------------------|---------------|--|
| Requirement | Plant | Key | GB | Power Station | Туре | E | NTSO-E RfG- Ge | nerating Unit Ty | pe | |
| | Type | 2 | Large Large | Medium | Small | D | C | B | A | |
| | • | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW (GB) | 1 – 10 MW (GB) | 8400W - 1 MW | |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected | |
| | | | > 10 MW ` | SHÈTL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV | |
| | | | (SHETL) | • | | and subject to | subject to Article | subject to Article | | |
| | | | | | | Article 4(3) and | 4(3) and Article 3 | 4(3) and Article 3 | | |
| | | | | | | Article 6 (d) | (6) (c) | <u>(6) (b)</u> | | |
| | | | should also be | | | | <u>Setpoint</u> target | | | |
| | | | able to respond to | | | | anywhere in the | | | |
| | | | transient events. | | | | Reactive Power | | | |
| | | | ix) For an onload | | | | Range, defined by | | | |
| | | | step change in | | | | Article 15 - (2) and | | | |
| | | | Connection Point | | | | <u>Article 16 – (3) (a)</u> | | | |
| | | | Voltage the | | | | and (b) with | | | |
| | | | reactive power | | | | setting steps no | | | |
| | | | output response | | | | greater than | | | |
| | | | shall commence | | | | 5MVAr or 5% | | | |
| | | | within 0.2 seconds | | | | (whichever is | | | |
| | | | of the application | | | | smaller) of full | | | |
| | | | of the step 90% of | | | | Reactive Power, | | | |
| | | | the full delivery of | | | | controlling the Reactive Power at | | | |
| | | | reactive power shall be achieved | | | | the Connection | | | |
| | | | within 1 | | | | Point to an | | | |
| 1 | | | second. | | | | accuracy within | | | |
| ! | | | x) Under transient | | | | ±5MVAr or ±5% | | | |
| | | | conditions the | | | | whichever is | | | |
| | | | Settling time shall | | | | smaller of the full | | | |
| | | | be no greater than | | | | reactive Power. | | | |
| | | | 2 seconds from | | | | iv) For Power | | | |
| | | | the application of | | | | Factor Control, the | | | |
| | | | the step change in | | | | Power Park | | | |
| | | | voltage and the | | | | Module shall be | | | |
| | | | peal to peak | | | | capable of | | | |
| | | | magnitude of any | | | | controlling the | | | |
| ' | | | oscillations shall | | | | Power Factor | | | |
| | | | be less than 5% of | | | | Control shall be | | | |
| | | | the change in | | | | capable of being | | | |
| | | | steady state | | | | controlled at the | | | |
| ' | | | Reactive Power | | | | Connection Point | | | |
| | | | within this time | | | | within the required | | | |

| | | | TABLE | de Comparison | on to ENTSO-E RfG | | | | |
|-------------|-------|-----|------------------------------------|-----------------|-------------------|------------------|---|--------------------|----------------------|
| Requirement | Plant | Key | GB | Power Station 1 | уре | E | NTSO-E RfG- Ge | nerating Unit Ty | ре |
| - | Type | 2 | Large | Medium | Small | D | C | B | A |
| | | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW_(GB) | 1 – 10 MW_(GB) | <u>8</u> 400W – 1 MW |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected |
| | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV |
| | | | (SHETL) | | | and subject to | subject to Article | subject to Article | |
| | | | | | | Article 4(3) and | 4(3) and Article 3 | 4(3) and Article 3 | |
| | | | | | | Article 6 (d) | <u>(6) (c)</u> | <u>(6) (b)</u> | |
| | | | frame. | | | | Reactive Range | | |
| | | | xi) The | | | | as defined by the | | |
| | | | Requirement for a | | | | Relevant Network | | |
| | | | Power System Stabiliser will be | | | | <u>Operator</u> | | |
| | | | specified in the | | | | according to Article 15 – (2) or | | |
| | | | Bilateral | | | | Article 15 – (2) or Article 16 – (3) – | | |
| | | | Agreement | | | | (a) and (b) DSO | | |
| | | | x) The overall | | | | with a Target | | |
| | | | voltage control | | | | Power Factor | | |
| | | | system shall | | | | value and | | |
| | | | respond to minor | | | | tolerance | | |
| | | | variations, steps, | | | | expressed in | | |
| | | | gradual changes | | | | MVAr or % on the | | |
| | | | or major variations | | | | Reactive Power | | |
| | | | xi) The overall | | | | value issued from | | |
| | | | voltage control | | | | the conversion of | | |
| | | | system shall have | | | | the Power Factor | | |
| | | | a limited | | | | value, within a | | |
| | | | bandwidth output | | | | period of time | | |
| | | | of between 0 – 5 | | | | following a sudden | | |
| | | | Hz. | | | | change of Active | | |
| | | | | | | | Power output. steps of no greater | | |
| | | | | | | | than 0.01.The | | |
| | | | | | | | Relevant Network | | |
| | | | | | | | Operator will | | |
| | | | | | | | specify the | | |
| | | | | | | | tolerance | | |
| | | | | | | | expressed in | | |
| | | | | | | | MVAr of % within | | |
| | | | | | | | a period of time | | |
| | | | | | | | following a sudden | | |
| | | | | | | | change of Active | | |

| | | | TABLE | 2 – GB Grid Co | ode Comparison | on to ENTSO-E RfG | | | | |
|-------------|-------|-----|----------------|----------------|-----------------|-------------------|------------------------------------|--------------------|----------------------|--|
| Requirement | Plant | Key | GB | Power Station | Гуре | Е | NTSO-E RfG- Ge | nerating Unit Ty | ре | |
| • | Type | 2 | Large | Medium | Small | D | C | B | _ _ A | |
| | | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW_(GB) | 1 – 10 MW_(GB) | <u>8</u> 400W – 1 MW | |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected | |
| | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV | |
| | | | (SHETL) | | | and subject to | subject to Article | subject to Article | | |
| | | | | | | Article 4(3) and | 4(3) and Article 3 | 4(3) and Article 3 | | |
| | | | | | | Article 6 (d) | (6) (c) | <u>(6) (b)</u> | | |
| | | | | | | | Power or step | | | |
| | | | | | | | change in voltage | | | |
| | | | | | | | at the Connection | | | |
| | | | | | | | Point pursuant to | | | |
| | | | | | | | Article 4(3). | | | |
| | | | | | | | v) The Control | | | |
| | | | | | | | Mode, parameter settings and | | | |
| | | | | | | | operating point for | | | |
| | | | | | | | steady state | | | |
| | | | | | | | Reactive Power | | | |
| | | | | | | | exchange at the | | | |
| | | | | | | | Connection Point | | | |
| | | | | | | | shall be | | | |
| | | | | | | | determined by the | | | |
| | | | | | | | Relevant Network | | | |
| | | | | | | | Operator in co- | | | |
| | | | | | | | ordination with the | | | |
| | | | | | | | Relevant TSO | | | |
| | | | | | | | pursuant to Article | | | |
| | | | | | | | 4 (3). | | | |
| | | | | | | | vi) The Relevant | | | |
| | | | | | | | Network Operator | | | |
| | | | | | | | ion co-ordination | | | |
| | | | | | | | with the Relevant | | | |
| | | | | | | | TSO (while | | | |
| | | | | | | | respecting the | | | |
| | | | | | | | provisions of Article 4(3) will | | | |
| | | | | | | | determine which | | | |
| | | | | | | | reactive power | | | |
| | | | | | | | control mode (ie | | | |
| | | | | | | | Voltage Control, | | | |
| | | | | | | | Reactive Power | | | |

| | | | TABLE | 2 – GB Grid C | ode Comparison t | on to ENTSO-E RfG | | | | |
|-------------|-------|-----|----------------|---------------|------------------|-------------------|----------------------------------|--------------------|----------------------|--|
| Requirement | Plant | Key | GB | Power Station | Туре | Е | NTSO-E RfG- Ge | nerating Unit Ty | ре | |
| | Type | 2 | Large | Medium | Small | D | C | B | A | |
| | | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW_(GB) | 1 – 10 MW (GB) | <u>8</u> 400W – 1 MW | |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected | |
| | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV | |
| | | | (SHETL) | | | and subject to | subject to Article | subject to Article | | |
| | | | | | | Article 4(3) and | 4(3) and Article 3 | 4(3) and Article 3 | | |
| | | | | | | Article 6 (d) | (6) (c) | <u>(6) (b)</u> | | |
| ı | | | | | | | Control or Power Factor Control) | | | |
| | | | | | | | mode) shall apply | | | |
| | | | | | | | including the | | | |
| | | | | | | | associated | | | |
| | | | | | | | Setpoints and | | | |
| | | | | | | | further equipment | | | |
| | | | | | | | necessary to | | | |
| | | | | | | | permit remote | | | |
| | | | | | | | operation. | | | |
| ı | | | | | | | vii) The Relevant | | | |
| | | | | | | | TSO (whilst respecting the | | | |
| | | | | | | | provisions of | | | |
| | | | | | | | Article 4(3)) will | | | |
| | | | | | | | determine if the | | | |
| | | | | | | | Power Park | | | |
| | | | | | | | Module is to be | | | |
| | | | | | | | fitted with a Power | | | |
| | | | | | | | Oscillation | | | |
| | | | | | | | Damping | | | |
| | | | | | | | facilitfacilitiesy (ie | | | |
| | | | | | | | a Power System | | | |
| | | | | | | | Stabiliser). The voltage and | | | |
| | | | | | | | reactive power | | | |
| | | | | | | | control | | | |
| | | | | | | | <u>characteristics</u> | | | |
| | | | | | | | shall not adversely | | | |
| | | | | | | | affect the damping | | | |
| | | | | | | | of power | | | |
| | | | | | | | oscillations. | | | |
| | | | | | | | pursuant to Article | | | |
| | | | | | | | 4(3) . | | | |

| Doguiromost | Dlant | Vari | | | ode Comparison | | | navatina Unit To | |
|---------------------|--------------|----------|-------------------|-----------------|-----------------|------------------|-------------------------|-----------------------|----------------------|
| Requirement | Plant | Key | | Power Station T | 71 | | | nerating Unit Ty | |
| | Туре | 2 | Large Large | Medium | Small | D | C | B | |
| | | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW_(GB) | 1 – 10 MW_(GB) | <u>8</u> 400W – 1 M\ |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connecte |
| | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110k |
| | | | (SHETL) | | | and subject to | subject to Article | subject to Article | |
| | | | | | | Article 4(3) and | 4(3) and Article 3 | 4(3) and Article 3 | |
| Other December | 0 | • | Deserting Desert | A 1 | N1/A | Article 6 (d) | (6) (c) | (6) (b) | NI/O |
| Other Reactive | Synchronous | 9 | Reactive Power | As per Large | N/A | As per Type B | None other than in | Required to have | N/S |
| Power Control | | | and Power Factor | | | and C | respect of the | a permanent | |
| Modes Grid Code | | | Control Modes | | | | requirements of | automatic | |
| | | | (excluding VAR | | | | Type B. The | excitation control | |
| CC.6.3.8(a)(v) | | | limiters) are not | | | | Relevant Network | system in order to | |
| ENTOO E | | | required unless | | | | Operator will | provide constant | |
| ENTSO-E - | | | specified by NGET | | | | specify what | alternator terminal | |
| Synchronous | | | in the Bilateral | | | | additional facilities | voltage without | |
| Article 121 _ 2(b) | | | Agreement | | | | are installed on | instability over the | |
| Article 12 –3(a) | | | | | | | the Synchronous | entire operating | |
| 5)Asynchronous | | | | | | | Power Generating | range of the | |
| Article 14 -1(a) | | | | | | | Facility in order to | synchronous | |
| Article 16 - | | | | | | | carry out voltage | Generating Unit as | |
| 3(e)(6). | | | | | | | and Reactive | per Article 121 – | |
| | | | | | | | Power control | 2(b). | |
| | | | | | | | within its area as | | |
| | | | | | | | detailed in Article | | |
| | | | | | | | 12 –3(a) (5) | | |
| | | | | | | | pursuant to Article | | |
| | | | | | | | 4(3). | | |
| Other Reactive | Asynchronous | <u>5</u> | Reactive Power | As per Large | N/A | As per Type C | Defined by the | Relevant Network | N/SPower P |
| Power Control | | | and Power Factor | | | | Relevant Network | Operator shall | Modules are |
| Modes | | | Control Modes | | | | Operator in | have the right to | required to h |
| Grid Code | | | (excluding VAR | | | | coordination with | define the | a Reactive |
| CC.6.3.8(a)(v) | | | limiters) are not | | | | the Relevant TSO | Reactive | Power Capab |
| =1.1=00 = | | | required unless | | | | (whilst respecting | Capability of a | to provide |
| ENTSO-E - | | | specified by NGET | | | | the provisions of | Power Park | Reactive Pov |
| Synchronous | | | in the Bilateral | | | | Article 4(3) under | Module whilst | at the high |
| Article 11 – 2(b) | | | Agreement | | | | Article 16 - 3(d) | respecting the | voltage termir |
| Article 12 –3(a) | | | | | | | (5)The Relevant | provisions of | of the step |
| 5)Asynchronous | | | | | | | Network Operator | Article 4(3).as per | transformer |
| Article 154 — | | | | | | | on co-ordination | Article 15 – 2(a)As | the voltage le |
| <u>(2)</u> 1(a) | | | | | | | with the Relevant | per Type A | of the |
| And Article 16 – | 1 | | ĺ | | | | TSO will | 1 | Connection P |

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| | | | TABLE | E 2 – GB Grid Co | de Comparison | to ENTSO-E Rf | G | | |
|--|---|-----|---|------------------------------------|---|---|--|---|--|
| Requirement | Plant | Key | GB | Power Station T | ype | E | NTSO-E RfG- Ge | nerating Unit Ty | ре |
| • | Type | 2 | Large | Medium | Small | D | C | B | . |
| | | | > 100 MW (E&W) > 30 MW (SPT) > 10 MW (SHETL) | 50 – 100MW N/A (SPT / SHETL) | < 50MW < 30MW (SPT) < 10 MW (SHETL) | > 30MW or connected at 110kV or above and subject to Article 4(3) and Article 6 (d) | 30 – 10 MW (GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (c) | 1 – 10 MW (GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) | 8400W – 1 MW and connected below 110kV |
| 3(<u>d</u> e)(<u>5</u> €). | | | | | | | determine which reactive power control mode (ie Voltage Control, Reactive Power Control or Power Factor Control mode) shall apply in accordance with Article 16 – 3)(e) (6). | | or at the alternator terminals if no step up transformer exists as defined by the Relevant DSO as defined in Article 14 – 1(a) pursuant to Article 4(3). |
| Steady State Load Inaccuracies GB CC.6.3.9 ENTSO-E Article 9 – 2(a)(2) | Synchronous and Asynchronous | 9 | The standard deviation of load error at steady state load over a 30 minute period must not exceed 2.5% of a Genset's Registered Capacity. | As per Large | N/A | N/SAs per Type C | N/SSpecified by Relevant Network Operator under Article 9 – 2(a)(2) pursuant to Article 4(3). | N/S | N/S |
| Negative Phase Sequence Loadings GB CC.6.3.10 ENTSO-E Article 911 – 3(a)(5) and Article 113 – (3)(a)(5) | Synchronous only (Asynchronou s captured under CC.6.3.15 Fault Ride Through requirements) | 9 | Each Synchronous Generating Unit is required to withstand without tripping the negative phase loading incurred by clearance of a close up phase to phase fault by system back up protection on the Transmission | As per Large | N/A | Not explicitly defined but believed to be covered under the fault ride through requirements of Article 9 – (3) (a) for Type B Power Generating Modules and Article 11 – | As per Type B | Not explicitly defined but believed to be covered under the fault ride through requirements of Article 9 – (3) (a) Specified by the Relevant Network Operator in accordance with Article 11 – 3(a)(5) and pursuant to | N/S |

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| | | | TABLE | 2 – GB Grid Co | de Comparison t | to ENTSO-E Rf | G | | | |
|---|------------------------------------|----------|--|------------------------------------|---|--|--|---|--|--|
| Requirement | Plant | Key | GB | Power Station T | уре | Е | NTSO-E RfG- Ge | nerating Unit Ty | Туре | |
| _ | Type | 2 | Large | Medium | Small | D | C | B | A | |
| | | | > 100 MW (E&W) > 30 MW (SPT) > 10 MW (SHETL) | 50 – 100MW N/A (SPT / SHETL) | < 50MW < 30MW (SPT) < 10 MW (SHETL) | > 30MW or connected at 110kV or above and subject to Article 4(3) and Article 6 (d) | 30 – 10 MW (GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (c) | 1 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) | 8400W – 1 MW and connected below 110kV | |
| | | | System. | | | (3) Specified by the Relevant Network Operator in accordance with Article 13 — 3(a)(5) | | Article 4(3) | | |
| Neutral Earthing (GB CC.6.3.11 ENTSO-E Article 109 – 6(fi) | Synchronous and Asynchronous | <u>5</u> | At nominal system voltages of 132kV and above the higher voltage windings of a transformer of a Generating Unit or Power Park Module must be star connected with the star point suitable for connection to Earth | As per Large | N/A | As per Type C | Specified by the Relevant Network Operator as per Article 109 – 6 (fi) | N/S | N/S | |
| Frequency Sensitive Relays (GB - CC.6.3.12 ENTSO-E Article 87 - (1)(a) and Article 8 - (1)(b) Article 1 - (b) | Synchronous and Asynchronous | <u>5</u> | As specified in CC.6.1.3 the System Frequency could rise to 52Hz or fall to 47Hz. Each Generating Unit must continue to operate within this frequency range for at least the time periods defined in CC.6.1.3 unless | As per Large | N/A | As per Type A | As per Type A | As per Type A | Tripping within the frequency and time ranges as specified in Table 2 of Article 87 – (1)(a) (which is broadly similar to the GB Frequency / time requirements) to be is prohibited unless otherwise agreed by the | |

| | | | TABLE | de Comparison | to ENTSO-E RfG | | | | |
|-------------|-------|-----|---|------------------------------------|---|--|--|---|--|
| Requirement | Plant | Key | GB | Power Station 1 | уре | Е | NTSO-E RfG- Ge | nerating Unit Ty | ре |
| • | Type | 2 | Large | Medium | Small | D | C | | A |
| | | | > 100 MW (E&W) > 30 MW (SPT) > 10 MW (SHETL) | 50 – 100MW N/A (SPT / SHETL) | < 50MW < 30MW (SPT) < 10 MW (SHETL) | > 30MW or connected at 110kV or above and subject to Article 4(3) and Article 6 (d) | 30 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (c) | 1 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) | 8400W – 1 MW and connected below 110kV |
| | | | NGET has agreed within the Bilateral Agreement to any Frequency level relays or rate of change of frequency relays which will trip the Generating Unit or Power Park Module | | | Article 6 (d) | (6) (c) | (6) (b) | Relevant TSO whilst respecting the provisions of pursuant to Article 4(3) A Generating Unit shall not disconnect from the Network due to rates of change of Frequency up to a value defined by the Relevant TSO whilst respecting the provisions of Article 4(3) 2Hz/s other than by loss of mains protection as specified in Article 87 – 1(b). The rate of change of frequency type |
| | | | | | | | | | loss of mains protection will be defined by the Relevant Network Operator in co- ordination with |

| | | | TABLE | 2 – GB Grid Co | de Comparison t | to ENTSO-E Rf | G | | |
|---|-----------------|----------|--|------------------------------------|---|--|--|---|--|
| Requirement | Plant | Key | GB | Power Station 1 | уре | Е | NTSO-E RfG- Ge | nerating Unit Ty | ре |
| - | Type | 2 | Large | Medium | Small | D | C | B | A |
| | | | > 100 MW (E&W) > 30 MW (SPT) > 10 MW (SHETL) | 50 – 100MW N/A (SPT / SHETL) | < 50MW < 30MW (SPT) < 10 MW (SHETL) | > 30MW or connected at 110kV or above and subject to Article 4(3) and Article 6 (d) | 30 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (c) | 1 – 10 MW (GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) | 8400W – 1 MW and connected below 110kV |
| Plant operation / protection outside | Synchronous and | <u>5</u> | Generating Units and Power Park | As per Large | N/A | As per Type A | As per Type A | As per Type A | the Relevant TSO. A Generating Unit shall be |
| the defined frequency / time operating ranges (GB CC.6.3.13 ENTSO-E Article 87- 1(a)(32)-and (3). | Asynchronous | | Modules will be will be responsible for protecting their plant outside the range 52 – 47 Hz. Should such excursions arise it is up to the Generating Unit to | | | | | | capable of automatic disconnection at specified frequencies if required by the Relevant Network Operator. Whilst |
| | | | disconnect their plant for the reasons of safety of plant and apparatus. | | | | | | respecting the provisions of Article 4(3) the terms and settings for automatic disconnection shall be agreed |
| | | | | | | | | | between the Relevant Network Operator and the Power Generating |
| | | | | | | | | | Facility Owner or as specified in the National Gric Code in accordance with Article 7— 1(a)(2) and (3) |

| Requirement | Plant | Key | GB | Power Station T | vpe | ENTSO-E RfG Generating Unit Type | | | | |
|--|--|-----|--|------------------------------------|---|---|--|--|--|--|
| • | Type | 2 | Large | Medium | Small | D | C | B | A | |
| | , | | > 100 MW (E&W) > 30 MW (SPT) > 10 MW (SHETL) | 50 – 100MW N/A (SPT / SHETL) | < 50MW < 30MW (SPT) < 10 MW (SHETL) | > 30MW or connected at 110kV or above and subject to Article 4(3) and Article 6 (d) | 30 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (c) | 1 – 10 MW (GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) | 8400W - 1 MW and connected below 110kV | |
| | | | | | | | | | pursuant to | |
| Fast Start Capability GB CC.6.3.14 (ENTSO-E Article 109 – 5(c)) | Synchronous and Asynchronous | 2,5 | NGET may specify in the Bilateral Agreement the requirement for a Genset to have a Fast Start Capability. Such Gensets may be used for Operating Reserve and be initiated by Frequency level relays in the range 49 – 50Hz | N/A unless specified by NGET | N/A | As per Type C | Quick resynchronisation capability is required in the case of disconnection as agreed between the Relevant Network Operator, Relevant TSQ and Power Generating FacilityGenerator as per Article 109 – 5(c), pursuant to Article 4(3) | N/S | N/S | |
| Fault Ride Through for short term faults up to 140ms. (CC.6.3.15(a) and Appendix 4A of the Connection Conditions ENTSO-E Article 9 – (3)(a)(1) – (7). Article 11 – (3) and Article 15 – (3) 11-3(a)(b)) Article 13-3(a)) | General Fault Ride Through Requirements applicable to Synchronous and Asynchronous Plant | 2,8 | In GB the Fault Ride Through Requirements for Synchronous and Asynchronous Plant are broadly the same. For faults up to 140ms in duration the following high level requirements apply: i) Each Generating Unit and Power Park Module shall remain transiently | As per Large | N/A | As per Type B and C except for the following additional requirements i) The voltage against time profile shall be defined by the TSO as per Figure 3 (ie the same as Types B and C) but with the parameters defined in | As per Type B | Under ENSTO-E. The majority of the Fault Ride Through requirements are specified as general Power Generating Module requirements with minor variations segregated between Synchronous and Asynchronous Plant unlike GB. A voltage Time | N/S | |

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| | | | TABLE | 2 – GB Grid Co | de Comparison | to ENTSO-E Rf0 | 3 | | |
|-------------|-------|-----|-------------------------------|-----------------|-----------------|-------------------------------|--------------------|-------------------------------------|----------------------|
| Requirement | Plant | Key | GB | Power Station T | уре | E | NTSO-E RfG- Ge | nerating Unit Ty | ре |
| - | Type | 2 | Large Large | Medium | Small | D | | B | A |
| | | | > 100 MW (E&W) | 50 - 100MW | < 50MW | > 30MW or | 30 – 10 MW (GB) | 1 – 10 MW_(GB) | <u>8</u> 400W – 1 MW |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected |
| | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV |
| | | | (SHETL) | | | and subject to | subject to Article | subject to Article | |
| | | | | | | Article 4(3) and | 4(3) and Article 3 | 4(3) and Article 3 | |
| | | | | | | Article 6 (d) | <u>(6) (c)</u> | <u>(6) (b)</u> | |
| | | | stable and | | | Tables 7.1 | | profile is also | |
| | | | connected to the | | | (Synchronous | | specified over the | |
| | | | System for any close up solid | | | Plant) and 7.2 (Power Park | | whole time frame unlike GB which | |
| | | | balanced or | | | Modules) | | specifies the | |
| | | | unbalanced fault | | | (instead of | | requirement for | |
| | | | operating at | | | Tables 3.1 and | | the period | |
| | | | Supergrid Voltage | | | 3.2). | | between 0 – | |
| | | | (ie above 200kV) | | | <u> </u> | | 140ms and for | |
| | | | for a total fault | | | ii) Each TSO | | voltage dips after | |
| | | | clearance time of | | | shall define and | | 140ms. | |
| | | | up to 140ms. A | | | make publically | | | |
| | | | solid three phase | | | available (whilst | | Under the | |
| | | | fault or | | | respecting the | | ENTSO-E Code | |
| | | | unbalanced earth | | | provisions of | | Power Generating | |
| | | | fault may result in | | | Article 4(3) the | | Modules | |
| | | | zero voltage on | | | pre-fault and | | (Synchronous and | |
| | | | the faulted phase | | | post fault conditions for | | Asynchronous Generators are | |
| | | | at the point of the fault. | | | the fault ride | | required (as per | |
| | | | ii) Each | | | through | | Article 191-3(a)(b) | |
| | | | Generating Unit or | | | capability | | (pursuant to Article | |
| | | | Power Park | | | according to | | 4(3)) to:- | |
| | | | Module shall be | | | Article 9 - (3)(3). | | (-)/ (-) | |
| | | | designed such that | | | iii)) For | | i) The TSO (whilst | |
| | | | upon clearance of | | | Synchronous | | respecting the | |
| | | | the fault on the | | | Generating | | provisions of | |
| | | | Transmission | | | Modules (Table | | pursuant to Article | |
| | | | System and within | | | 7.1) the | | 4(3) will define a | |
| | | | 0.5 seconds of the | | | requirements in | | voltage against | |
| | | | restoration of the | | | GB apply in | | time profile | |
| | | | voltage at the | | | respect of faults | | according to | |
| | | | Connection Point | | | on the | | Figure 3 at the | |
| | | | to the minimum | | | <u>Transmission</u> | | Connection Point | |

| | | | TABLI | E 2 – GB Grid Co | de Comparison | to ENTSO-E Rf | G | | |
|-------------|-------|-----|---|------------------------------------|---|---|--|---|--|
| Requirement | Plant | Key | GB | Power Station T | vpe | Е | NTSO-E RfG- Ge | enerating Unit Ty | pe |
| • | Type | 2 | Large | Medium | Small | D | C | B | A |
| | | | > 100 MW (E&W) > 30 MW (SPT) > 10 MW (SHETL) | 50 – 100MW N/A (SPT / SHETL) | < 50MW < 30MW (SPT) < 10 MW (SHETL) | > 30MW or connected at 110kV or above and subject to Article 4(3) and Article 6 (d) | 30 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (c) | 1 – 10 MW (GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) | 8400W – 1 MW and connected below 110kV |
| | | | levels defined in CC.6.1.4, 90% of the pre fault Active Power generated by the Generating Unit or Power Park Module shall be restored and supplied to the System. iii) In addition during the period of the fault when the voltage is outside of nominal limits each Generating Unit or Power Park Module shall generate maximum reactive current without exceeding the transient rating of the Generating Unit or Power Park Module | | | Network not in respect of the connection voltage to which the Generating Unit connects. For Type D units the requirements are somewhat different but considered to be broadly consistent with the GB Code. Under Table 7.1 the Power Generating Module must remain connected for a retained voltage of 0 p.u for a time period of between 140ms — 300ms with regional variations being specified by the TSO. For Power Park Modules (Table 7.2) the same voltage profile | | for fault conditions which describes the conditions in which the Power Generating Module shall be capable of staying connected to the Network and continuing stable operation after the power system has been disturbed by Secured Faults on the Network. (within the beundaries defined by Figure 5 — minimum voltage at the connection point being defined by the TSO but could range between 0.3 p.u and 0.05 p.u for between 150ms and 250ms) under which the Synchronous Generating Unit shall stay connected and stable after the | |

| | TABLE 2 – GB Grid Code Compa | | | | | | on to ENTSO-E RfG | | | |
|-------------|------------------------------|-----|----------------|-----------------|-----------------|---|--------------------|-------------------------------|---------------|--|
| Requirement | Plant | Key | GB | Power Station 1 | Гуре | Е | NTSO-E RfG- Ge | enerating Unit Ty | pe | |
| | Type | 2 | Large | Medium | Small | D | C | B | A | |
| | | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW (GB) | 1 – 10 MW (GB) | 8400W - 1 MW | |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected | |
| | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV | |
| | | | (SHETL) | | | and subject to | subject to Article | subject to Article | | |
| | | | | | | Article 4(3) and | 4(3) and Article 3 | 4(3) and Article 3 | | |
| | | | | | | Article 6 (d) | (6) (c) | <u>(6) (b)</u> | | |
| | | | | | | exists as in | | power system has | | |
| | | | | | | Figure 3 with a | | been disturbed by | | |
| | | | | | | <u>minimum</u> | | secured faults | | |
| | | | | | | retained voltage | | (balanced and | | |
| | | | | | | of 0 p.u and a | | unbalanced faults) | | |
| | | | | | | time range of | | on the network | | |
| | | | | | | between 140ms | | unless the | | |
| | | | | | | <u>– 250ms.</u> iv Under ENSTO- | | protection scheme | | |
| | | | | | | E The Fault Ride | | requires the disconnection of | | |
| | | | | | | Through | | the Generating | | |
| | | | | | | requirements | | Unit from the | | |
| | | | | | | are segregated | | Network | | |
| | | | | | | between | | ii) The voltage | | |
| | | | | | | Synchronous | | against time profile | | |
| | | | | | | and | | shall be expressed | | |
| | | | | | | Asynchronous | | by aas the lower | | |
| | | | | | | Plant unlike GB. | | limit of the course | | |
| | | | | | | A voltage Time | | of the phase to | | |
| | | | | | | profile is also | | phase Voltages on | | |
| | | | | | | specified over | | the Network | | |
| | | | | | | the whole time | | Voltage level at | | |
| | | | | | | frame unlike GB | | the Connection | | |
| | | | | | | which specifies | | Point during a | | |
| | | | | | | the requirement | | symmetrical fault | | |
| | | | | | | for the period | | as a function of | | |
| | | | | | | between 0 – | | time before during | | |
| | | | | | | 140ms and for | | and after the fault. | | |
| | | | | | | voltage dips | | The lower limit is | | |
| | | | | | | after 140ms. | | defined by the | | |
| | | | | | | | | TSO using | | |
| | | | | | | Under the | | parameters in | | |
| | | | | | | ENTSO-E Code | | Figure 3 according | | |
| | | 1 | | 1 | 1 | Synchronous | 1 | to Table 3.1 | | |

| | TABLE 2 – GB Grid Code Compa | | | | | | on to ENTSO-E RfG | | | |
|-------------|------------------------------|-----|----------------|------------------------|-----------------|------------------------------------|--------------------|-------------------------------------|----------------------|--|
| Requirement | Plant | Key | GB | Power Station T | vpe | Е | NTSO-E RfG- Ge | nerating Unit Ty | pe | |
| | Type | 2 | Large | Medium | Small | D | C | B | A | |
| | | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW_(GB) | 1 – 10 MW_(GB) | <u>8</u> 400W – 1 MW | |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected | |
| | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV | |
| | | | (SHETL) | | | and subject to | subject to Article | subject to Article | | |
| | | | | | | Article 4(3) and | 4(3) and Article 3 | 4(3) and Article 3 | | |
| | | | | | | Article 6 (d) | (6) (c) | <u>(6) (b)</u> | | |
| | | | | | | Generators are | | (Synchronous | | |
| | | | | | | required (as per | | Power Generating | | |
| | | | | | | Article 13-3(a) | | Modules) and | | |
| | | | | | | (pursuant to | | Table 3.2 (Power | | |
| | | | | | | Article 4(3)) to:- | | Park Modules) as | | |
| | | | | | | " TI TOO | | described in | | |
| | | | | | | i) The TSO | | <u>Article 9 – (3).</u> | | |
| | | | | | | (pursuant to Article 4(3)) will | | iii) For | | |
| | | | | | | define a voltage | | Synchronous Generating | | |
| | | | | | | against time | | Modules (Table | | |
| | | | | | | profile at the | | 3.1) the | | |
| | | | | | | Connection | | requirements in | | |
| | | | | | | Point (within the | | GB apply in | | |
| | | | | | | boundaries | | respect of faults | | |
| | | | | | | defined by | | on the | | |
| | | | | | | Figure 7 - | | Transmission | | |
| | | | | | | minimum | | Network not in | | |
| | | | | | | voltage at the | | respect of the | | |
| | | | | | | connection point | | connection voltage | | |
| | | | | | | being 0 p.u for | | to which the | | |
| | | | | | | 150ms up to | | Generating Unit | | |
| | | | | | | 250ms) under | | connects. For | | |
| | | | | | | which the | | Type B units the | | |
| | | | | | | Synchronous | | requirements are | | |
| | | | | | | Generating Unit | | somewhat | | |
| | | | | | | shall stay | | different but | | |
| | | | | | | connected and stable after the | | considered to be broadly consistent | | |
| | | | | | | power system | | with the GB Code. | | |
| | | | | | | has been | | Under Table 3.1 | | |
| | | | | | | disturbed by | | the Power | | |
| | | | | | | secured faults | | Generating | | |
| | | 1 | | | | on the network | | Module must | | |

| | | | TABLI | E 2 – GB Grid Co | ode Comparison | to ENTSO-E Rf | G | | |
|-------------|-------|-----|----------------|------------------|-----------------|-----------------------------------|--------------------|------------------------------|----------------------|
| Requirement | Plant | Key | | Power Station | | ENTSO-E RfG Generating Unit Type | | | |
| • | Type | 2 | Large | Medium | Small | D | C | B | A |
| | | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW (GB) | 1 – 10 MW (GB) | <u>8</u> 400W – 1 MW |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected |
| | | | > 10 MW ` | SHÈTL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV |
| | | | (SHETL) | | , , | and subject to | subject to Article | subject to Article | |
| | | | | | | Article 4(3) and | 4(3) and Article 3 | 4(3) and Article 3 | |
| | | | | | | Article 6 (d) | (6) (c) | <u>(6) (b)</u> | |
| | | | | | | (balanced and | | remain connected | |
| | | | | | | unbalanced | | for a retained | |
| | | | | | | faults) unless | | voltage of | |
| | | | | | | the protection | | <u>between 0.05 –</u> | |
| | | | | | | scheme requires | | 0.3 p.u for a time | |
| | | | | | | the | | period of between | |
| | | | | | | disconnection of | | <u>140ms – 300ms</u> | |
| | | | | | | the Generating | | with regional | |
| | | | | | | Unit from the | | variations being | |
| | | | | | | Network. | | specified by the | |
| | | | | | | ii) The voltage against time | | TSO. For the | |
| | | | | | | profile shall be | | Power Park Modules (Table | |
| | | | | | | expressed as | | 3.2) the same | |
| | | | | | | the lower limit of | | voltage profile | |
| | | | | | | the lowest phase | | exists as in Figure | |
| | | | | | | voltage (in the | | 3 with a minimum | |
| | | | | | | case of | | retained voltage of | |
| | | | | | | asymmetrical | | between 0.05 – | |
| | | | | | | faults the lowest | | 0.15 p.u and a | |
| | | | | | | phase voltage | | time range of | |
| | | | | | | shall be used | | between 140ms – | |
| | | | | | | irrespective of | | 250ms. lowest | |
| | | | | | | the voltage drop | | phase voltage (in | |
| | | | | | | on the other two | | the case of | |
| | | | | | | phases) as a | | asymmetrical | |
| | | | | | | function of time | | faults the lowest | |
| | | | | | | both during and | | phase voltage | |
| | | | | | | after the fault. | | shall be used | |
| | | | | | | iii) Each TSO | | irrespective of the | |
| | | | | | | (pursuant to | | voltage drop on | |
| | | 1 | | | | Article 4(3))will | | the other two | |
| | | 1 | | | | define the pre- | | phases) as a | |
| | | | | | | fault and post | ĺ | function of time | |

| | | | TABLE | de Comparison | on to ENTSO-E RfG | | | | |
|-------------|-------|-----|---|------------------------------------|---|---|--|--|--|
| Requirement | Plant | Key | GB | Power Station 1 | уре | E | NTSO-E RfG- Ge | nerating Unit Ty | ре |
| • | Type | 2 | Large | Medium | Small | D | C | | A |
| | | | > 100 MW (E&W) > 30 MW (SPT) > 10 MW (SHETL) | 50 – 100MW N/A (SPT / SHETL) | < 50MW < 30MW (SPT) < 10 MW (SHETL) | > 30MW or connected at 110kV or above and subject to Article 4(3) and Article 6 (d) | 30 – 10 MW (GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (c) | 1 – 10 MW (GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) | 8400W – 1 MW and connected below 110kV |
| | | | | | | fault conditions for fault ride through in terms of the pre fault minimum short circuit capacity at the Connection Point, the conditions for pre fault active and Reactive Power operating point of the Generating Unit 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 and to post fault minimum short circuit capacity at the Connection Point and the Connection Point and the Connection Point and the Connection Point and the Connection Point iv) Each Network Operator(pursua and to Article 4(3) | | both during and after the fault. iii) Each TSO (whilst respecting the provisions of pursuant to Article 4(3)) will shall define (and make publically available) the prefault and post fault ride through in terms of the conditions for fault ride through in terms of the conditions for calculation of the pre fault minimum short circuit capacity at the Connection Point, the conditions for pre fault active and Reactive Power operating point of the Power Generating Module-Unit at the Connection Point and Voltage at the Connection Foint and conditions for the calculation of the post fault | |

| TABLE 2 – GB Grid Code Comparison to ENTSO-E RfG | | | | | | | | | | |
|--|-------|-----|----------------|-----------------|-----------------|-----------------------------------|--------------------|-------------------------------|----------------------|--|
| Requirement | Plant | Key | GB | Power Station 1 | Гуре | ENTSO-E RfG Generating Unit Type | | | | |
| . | Type | 2 | Large | Medium | Small | D | C | | A | |
| | | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW_(GB) | 1 – 10 MW (GB) | <u>8</u> 400W – 1 MW | |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected | |
| | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV | |
| | | | (SHETL) | | | and subject to | subject to Article | subject to Article | | |
| | | | | | | Article 4(3) and | 4(3) and Article 3 | 4(3) and Article 3 | | |
| | | | | | | Article 6 (d) | (6) (c) | <u>(6) (b)</u> | | |
| | | | | | | pre and post | | circuit capacity at | | |
| | | | | | | fault parameters | | the Connection | | |
| | | | | | | for fault ride | | Point | | |
| | | | | | | through | | iv) Each Relevant | | |
| | | | | | | capability as an | | Network Operator | | |
| | | | | | | outcome of the | | (pursuant to Article | | |
| | | | | | | calculations at | | 4(3) shall provide | | |
| | | | | | | the Connection | | on request by the | | |
| | | | | | | Point regarding | | Power Generating | | |
| | | | | | | the pre-fault | | Facility Owner | | |
| | | | | | | circuit capacity | | define the pre and post fault | | |
| | | | | | | at each | | | | |
| | | | | | | Connection | | conditionsparamet ers to be | | |
| | | | | | | Point expressed | | considered for | | |
| | | | | | | in MVA, the pre | | fault ride through | | |
| | | | | | | fault operating | | capability as an | | |
| | | | | | | point of the | | outcome of the | | |
| | | | | | | generating unit | | calculations at the | | |
| | | | | | | expressed in | | Connection Point | | |
| | | | | | | Active Power | | as defined in | | |
| | | | | | | output and | | Article 9 –(3) (a) | | |
| | | | | | | Reactive Power | | point (3) regarding | | |
| | | | | | | Output at the | | the pre-fault | | |
| | | | | | | Connection | | minimum short | | |
| | | | | | | Point and | | circuit capacity at | | |
| | | | | | | voltage at the | | each Connection | | |
| | | | | | | Connection | | Point expressed in | | |
| | | | | | | Point, the Post | | MVA, the pre fault | | |
| | | | | | | fault minimum | | operating point of | | |
| | | | | | | short circuit | | the <u>Power</u> | | |
| | | | | | | capacity at each | | <u>G</u> generating | | |
| | | | | | | Connection | | <u>Module</u> unit | | |
| | | | | | I | Point expressed | ĺ | expressed in | 1 | |

| TABLE 2 – GB Grid Code Comparison to ENTSO-E RfG Requirement Type Code Comparison to ENTSO-E RfG Septending Unit Type Septending | 8400W - 1 MW and connected below 110kV |
|---|--|
| Type 2 | A <u>8</u> 400W – 1 MW <u>and connected</u> |
| > 30 MW (SPT) | and connected |
| > 10 MW (SHETL) | |
| (SHETL) and subject to Article Article 4(3) and Article 3 Article 6 (d) Article 6 (d) Subject to Article 4(3) and Article 3 (6) (c) (6) (b) | below 110kV |
| Article 4(3) and Article 3 Article 6 (d) Article 6 (d) Article 3 (6) (c) (6) (b) | |
| Article 6 (d) (6) (c) (6) (b) | |
| | |
| in MVA. Active Power | |
| iv) The output and | |
| Undervoltage Reactive Power | |
| protection on the Output at the | |
| Generating Unit Connection Point | |
| should be set to and Vvoltage at | |
| the widest the Connection | |
| possible range Point and -the | |
| by the Generator 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. | |
| Undervoltage | |
| protection on the | |
| Power Generating | |
| ModuleUnit (as set | |
| by the Generator) | |
| should be set to | |
| the widest | |
| technical capability | |
| unless the Polyment Network | |
| Relevant Network Operator requires | |

| | TABLE 2 – GB Grid Code Comparison to ENTSO-E RfG | | | | | | | | | | | |
|-------------|--|-----|----------------|---------------|-----------------|-----------------------------------|--------------------|----------------------------|---------------|--|--|--|
| Requirement | Plant | Key | GB | Power Station | Туре | ENTSO-E RfG Generating Unit Type | | | | | | |
| • | Type | 2 | Large | Medium | Small | D | C | I B | A | | | |
| | | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW (GB) | 1 – 10 MW (GB) | 8400W - 1 MW | | | |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected | | | |
| | | | > 10 MW ` ′ | SHÈTL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV | | | |
| | | | (SHETL) | , | , , | and subject to | subject to Article | subject to Article | | | | |
| | | | , , | | | Article 4(3) and | 4(3) and Article 3 | 4(3) and Article 3 | | | | |
| | | | | | | Article 6 (d) | (6) (c) | (6) (b) | | | | |
| | | | | | | | | narrower settings | | | | |
| | | | | | | | | according to | | | | |
| | | | | | | | | Article 9 – (5) (b). | | | | |
| | | | | | | | | The settings to be | | | | |
| | | | | | | | | justified by the | | | | |
| | | | | | | | | Generator.possibl | | | | |
| | | | | | | | | e range | | | | |
| | | | | | | | | vi) The fault ride | | | | |
| | | | | | | | | <u>through</u> | | | | |
| | | | | | | | | capabilities for | | | | |
| | | | | | | | | <u>asymmetrical</u> | | | | |
| | | | | | | | | faults shall be | | | | |
| | | | | | | | | defined by each | | | | |
| | | | | | | | | Relevant TSO | | | | |
| | | | | | | | | (whilst respecting | | | | |
| | | | | | | | | the provisions | | | | |
| | | | | | | | | ofpursuant to | | | | |
| | | | | | | | | Article 4(3)). will | | | | |
| | | | | | | | | specify the | | | | |
| | | | | | | | | requirements for | | | | |
| | | | | | | | | 90% of the Active | | | | |
| | | | | | | | | Power to be | | | | |
| | | | | | | | | restored on fault | | | | |
| | | | | | | | | clearance | | | | |
| | | | | | | | | measured from the | | | | |
| | | | | | | | | time the voltage | | | | |
| | | | | | | | | has recovered | | | | |
| | | | | | | | | above 85% of the | | | | |
| | | | | | | | | pre-fault nominal | | | | |
| | | | | | | | | voltage value. The maximum | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | recovery period | | | | |
| | | | | | | | | shall be greater | | | | |
| | | 1 | | | | 1 | 1 | than 0.5 seconds | | | | |

| Damiliana | Diami | I/ av | | | ode Comparison | | | manatina Hait To | |
|------------------------|---------------|-------|--------------------|-----------------|-----------------|-------------------------------|---------------------|----------------------|----------------------|
| Requirement | Plant | Key | | Power Station T | | | | enerating Unit Ty | |
| | Туре | 2 | Large Large | Medium | Small | D | | B | .A |
| | | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW (GB) | 1 – 10 MW_(GB) | <u>8</u> 400W – 1 MW |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected |
| | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV |
| | | | (SHETL) | | | and subject to | subject to Article | subject to Article | |
| | | | | | | Article 4(3) and | 4(3) and Article 3 | 4(3) and Article 3 | |
| | | | | | | Article 6 (d) | <u>(6) (c)</u> | <u>(6) (b)</u> | |
| | | | | | | | | and less than 15 | |
| | | | | | | | | seconds. | |
| | | | | | | | | vi) The Relevant | |
| | | | | | | | | TSO shall define | |
| | | | | | | | | (whilst respecting | |
| | | | | | | | | the provisions of | |
| | | | | | | | | Article 4(3) the | |
| | | | | | | | | time and | |
| | | | | | | | | magnitude of the | |
| | | | | | | | | post fault Active | |
| | | | | | | | | Power Recovery. | |
| Fault Ride | -Fault Ride | | | | | | | <u> </u> | |
| hrough for short | Through | | | | | | | | |
| term faults up to | Requirements | | | | | | | | |
| 140ms. | rioquiromonio | | | | | | | | |
| CC.6.3.15(a) and | | | | | | | | | |
| Appendix 4A of | | | | | | | | | |
| the Connection | | | | | | | | | |
| Conditions | | | | | | | | | |
| NTSO-E Article | | | | | | | | | |
| 11-3(a)(b)) | | | | | | | | | |
| Article 13-3(a)) | | | | | | | | | |
| Fault Ride | Synchronous | 2, 6 | | As per Large | N/A | Under the | As per Type B | Under the | |
| Through for long | and | | In addition to the | | | ENTSO-E RfG | <u>Under the</u> | ENTSO-E RfG no | |
| rm faults greater | Asynchronous | | fault ride through | | | no distinction is | ENTSO-E RfG no | distinction is made | |
| than 140ms. | • | | requirements for | | | made between | distinction is made | between short and | |
| CC.6.3.15(b) and | | | short duration | | | short and long | between short and | long duration | |
| Appendix 4A of | | | faults | | | duration faults | long duration | faults. See Article | |
| the Connection | | | (CC.6.3.15(a) | | | see Article 11 - | faults. See Article | 9 - (3)(a)(1) - (7) | |
| Conditions | | | each Generating | | | 3(a) (b) , Article | 9 - (3)(a)(1) - (7) | Article 11 – (3) | |
| ENTSO-E Article | | | Unit and Power | | | 13-3(a) Article | Article 11 – (3) | and Article 15 - | |
| -(3)(a)(1)-(7) | | | Park Module is | | | 17-1(a) and | Article 15 – | (2((b)(3) 11-3(a)(b) | |
| Article 11 – (3), | | | required to:- | | | Article 15-3(a) | (2((b)(3) and | and Article 15-3(a) | |

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| | | | TABLE | 2 – GB Grid Co | de Comparison | to ENTSO-E Rf | G | | |
|--|-------|-----|--|------------------------------------|---|--|--|--|--|
| Requirement | Plant | Key | GB | Power Station T | уре | E | NTSO-E RfG- Ge | nerating Unit Ty | ре |
| - | Type | 2 | Large | Medium | Small | D | | B | . A |
| | | | > 100 MW (E&W) > 30 MW (SPT) > 10 MW (SHETL) | 50 – 100MW N/A (SPT / SHETL) | < 50MW < 30MW (SPT) < 10 MW (SHETL) | > 30MW or connected at 110kV or above and subject to Article 4(3) and Article 6 (d) | 30 – 10 MW (GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (c) | 1 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) | 8400W – 1 MW and connected below 110kV |
| Article 15 – (2)(b)(3) and Article 16 – (3)(e)11-3l(a)(b), Article 13-3(a), Article 15 – 3(a) (b) and Article 17- 1(a) | | | i) Remain transiently stable and connected to the System without tripping for any Balanced Supergrid Voltage dips anywhere on or above the heavy black line of Figure 5 defined under CC.6.3.15(b). ii) Provide Active Power output at least in proportion to the retained balanced voltage at the Connection Point allowing for a reduction in the power output of a Power Park Module where the primary energy source has reduced iii) Generate maximum reactive current without exceeding the | | | (b). The Reactive injection during system faults and disturbances for Power Park Modules is covered under Article 15 -2. | Article 16 – (3)(e). | (b). The Reactive injection during system faults and disturbances for Pewer Park Modules is covered under Article 15 -2. | |

| | TABLE 2 – GB Grid Code Comparison to ENTSO-E RfG | | | | | | | | | | |
|---|--|-------------|--|------------------------------------|---|---|--|--|--|--|--|
| Requirement | Plant | Key | GB | Power Station T | ype | E | NTSO-E RfG- Ge | nerating Unit Ty | pe | | |
| • | Type | 2 | Large | Medium | Small | D | C | B | A | | |
| | | | > 100 MW (E&W) > 30 MW (SPT) > 10 MW (SHETL) | 50 – 100MW N/A (SPT / SHETL) | < 50MW < 30MW (SPT) < 10 MW (SHETL) | > 30MW or connected at 110kV or above and subject to Article 4(3) and Article 6 (d) | 30 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (c) | 1 – 10 MW (GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) | 8400W – 1 MW and connected below 110kV | | |
| | | | transient rating of the Generating Unit or Power Park Module during the period of the voltage dip | | | | | | | | |
| | | | iv) Restore Active Power output to at least 90% of its pre fault output (unless there has been a reduction in the primary energy source to the Power Park Module) within 1 second of restoration of the voltage at the Connection Point. | | | | | | | | |
| Fault Ride Through – Other Requirements Operation under high wind speed or emergency shutdown conditions (GB CC.6.3.15.3(i) ENTSO-E – Article 17-1(a) or Article 15-(3) | Asynchronous | <u>2, 5</u> | For Power Park Modules comprising of wind turbine generating units the fault ride through requirements do not apply when the wind farm is operating at less than 5% of Rated MW output or | As per Large | N/A | As per Type BNot explicitly specified but could be within the framework of Article 17-1(a) by being specified by the Relevant TSO pursuant to Article 4(3). | As per Type BG | Not explicitly specified but could be within the framework of Article 15-(3) by being specified by the Relevant TSO, pursuant to Article 4(3). | N/S | | |

| | TABLE 2 – GB Grid Code Comparison to ENTSO-E RfG | | | | | | | | | | | |
|---|--|-------------|--|------------------------------------|---|--|--|---|--|--|--|--|
| Requirement | Plant | Key | GB | Power Station T | уре | E | NTSO-E RfG- Ge | nerating Unit Ty | ре | | | |
| | Туре | 2 | Large | Medium | Small | D | C | B | A | | | |
| | | | > 100 MW (E&W) > 30 MW (SPT) > 10 MW (SHETL) | 50 – 100MW N/A (SPT / SHETL) | < 50MW < 30MW (SPT) < 10 MW (SHETL) | > 30MW or connected at 110kV or above and subject to Article 4(3) and Article 6 (d) | 30 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (c) | 1 – 10 MW (GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) | 8400W – 1 MW and connected below 110kV | | | |
| | | | when 50 % or more of the wind turbines have been shut down due to emergency shut down sequence. | | | | | | | | | |
| Fault Ride Through – Other Requirements Negative Phase sequence loading CC.6.3.15.3(ii) ENTSO-E – Article 9 – (3)(a)(7) and Article 11 – 3(a)(4)17-1(a) or Article 15-3). | Asynchronous | <u>2, 5</u> | Each Power Park Module must be able to withstand without tripping the negative phase sequence loading incurred by clearance of a close up phase to phase fault by System Back up Protection on the Transmission System operating at Supergrid Voltage. | As per Large | N/A | Specified by the Relevant Network Operator (whilst respecting the provisions of pursuant to Article 4(3)) in accordance with Article 11 – 3(a)(4)17 – 1(a) | As per Type C | Specified by the Relevant Network Operator (<u>whilst respecting the provisions of pursuant to Article 4(3)) in accordance with Article 915 – (3)(a)(7).</u> | N/S | | | |
| Reactive Current Injection during System faults and Disturbances CC.6.3.15 Article 15-2 | Synchronous | <u>5</u> | Maximum Reactive Current to be injected during the period of the fault without exceeding the Transient Rating of the Generating Unit as specified in | As per Large | N/A | N/S | N/S | N/S | N/S | | | |

| | | | TABLE | 2 – GB Grid Co | de Comparison | to ENTSO-E Rf | G | | | |
|---|-------------------|-----|--|------------------------------------|---|--|---|---|--|--|
| Requirement | Plant | Key | GB | Power Station T | уре | E | ENTSO-E RfG Generating Unit Type | | | |
| • | Type | 2 | Large | Medium | Small | D | C | B | . A | |
| | | | > 100 MW (E&W) > 30 MW (SPT) > 10 MW (SHETL) | 50 – 100MW N/A (SPT / SHETL) | < 50MW < 30MW (SPT) < 10 MW (SHETL) | > 30MW or connected at 110kV or above and subject to Article 4(3) and Article 6 (d) | 30 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (c) | 1 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) | 8400W – 1 MW and connected below 110kV | |
| | | | CC.6.3.15. | | | | | | | |
| Reactive Current Injection during System faults and Disturbances CC.6.3.15 Article 15-2 ENTSO-E 15 – 2(b) (c) and Article 16 – (3)(e) | AsSynchronou s | 2.6 | Maximum Reactive Current to be injected during the period of the fault without exceeding the Transient Rating of the Generating Unit as specified in CC.6.3.15.1(a) and (b). | As per Large | N/A | As per Type B. | As per Type B, In addition the Relevant TSO shall define (whilst respecting the provisions of Article 4(3)) the priority of Active or Beactive Power injection during the fault which shall be established no later than 150ms from fault inception as detailed in Article 16 – (3)(e). | The Relevant Network Operator in co-ordination with the Relevant TSO shall have the right to require (whilst respecting the provisions of Article 4(3)) fast acting additional reactive Current injection at the Connection Point to the pre-fault reactive Current injection in the case of symmetrical faults. i) The Power Park Module shall be capable of activating this additional reactive current injection during the period of faults. The Power Park Module shall be capable of is the current injection during the period of faults. The Power Park Module shall be capable of either | N/S | |

| | TABLE 2 – GB Grid Code Comparison to ENTSO-E RfG | | | | | | | | | | | |
|-------------|--|-----|----------------|-----------------|-----------------|------------------------------------|--|--|----------------------|--|--|--|
| Requirement | Plant | Key | GB | Power Station 1 | Гуре | ENTSO-E RfG– Generating Unit Type | | | | | | |
| • | Type | 2 | Large | Medium | Small | D | | B | A | | | |
| | | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW_(GB) | 1 – 10 MW (GB) | <u>8</u> 400W – 1 MW | | | |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected | | | |
| | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV | | | |
| | | | (SHETL) | | | and subject to Article 4(3) and | subject to Article 4(3) and Article 3 | subject to Article 4(3) and Article 3 | | | | |
| | | | | | | Article 4(3) and Article 6 (d) | (6) (c) | (6) (b) | | | | |
| | | | | | | rudio o (a) | 10/10/ | additional reactive | | | | |
| | | | | | | | | Current at the | | | | |
| | | | | | | | | Connection Point | | | | |
| | | | | | | | | (as specified by | | | | |
| | | | | | | | | the Relevant TSO) of the magnitude | | | | |
| | | | | | | | | of this current, | | | | |
| | | | | | | | | depending on the | | | | |
| | | | | | | | | deviation of the | | | | |
| | | | | | | | | Voltage at the | | | | |
| | | | | | | | | Connection Point from its nominal | | | | |
| | | | | | | | | value or | | | | |
| | | | | | | | | raide of | | | | |
| | | | | | | | | Alternatively | | | | |
| | | | | | | | | measuring voltage | | | | |
| | | | | | | | | deviations at the terminals of the | | | | |
| | | | | | | | | individual units of | | | | |
| | | | | | | | | the Power Park | | | | |
| | | | | | | | | Module and | | | | |
| | | | | | | | | providing an | | | | |
| | | | | | | | | additional reactive | | | | |
| | | | | | | | | Current at the terminals of these | | | | |
| | | | | | | | | units according to | | | | |
| | | | | | | | | further | | | | |
| | | | | | | | | specifications by | | | | |
| | | | | | | | | the Relevant | | | | |
| | | | | | | | | Network Operator | | | | |
| | | | | | | | | in co-ordination with the Relevant | | | | |
| | | | | | | | | TSO of the | | | | |
| | | | | | | | | magnitude of this | | | | |

| | TABLE 2 – GB Grid Code Comparison to ENTSO-E RfG | | | | | | | | | | | |
|-------------|--|-----|--------------------------|--------------------------|------------------------|-----------------------------------|----------------------------------|-----------------------------------|-------------------------------|--|--|--|
| Requirement | Plant | Key | GB | Power Station | Гуре | ENTSO-E RfG– Generating Unit Type | | | | | | |
| • | Type | 2 | Large | Medium | Small | D | C | B | . A | | | |
| | | | > 100 MW (E&W) | 50 – 100MW N/A (SPT / | < 50MW < 30MW (SPT) | > 30MW or connected at | 30 – 10 MW (GB) and connected | 1 – 10 MW_(GB) and connected | 8400W – 1 MW and connected | | | |
| | | | > 30 MW (SPT) > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV | | | |
| | | | (SHETL) | OHLTE) | < TO WWW (OTTETE) | and subject to | subject to Article | subject to Article | DEIOW I TORV | | | |
| | | | (0.12.2) | | | Article 4(3) and | 4(3) and Article 3 | 4(3) and Article 3 | | | | |
| | | | | | | Article 6 (d) | (6) (c) | (6) (b) | | | | |
| | | | | | | | | current depending | | | | |
| | | | | | | | | on the deviation of | | | | |
| | | | | | | | | the Voltage at units terminals | | | | |
| | | | | | | | | from its nominal | | | | |
| | | | | | | | | value. | | | | |
| | | | | | | | | raidor | | | | |
| | | | | | | | | Under either of | | | | |
| | | | | | | | | these options the | | | | |
| | | | | | | | | Power Park | | | | |
| | | | | | | | | Module shall be capable of | | | | |
| | | | | | | | | providing at least | | | | |
| | | | | | | | | 2/3 of the | | | | |
| | | | | | | | | additional reactive | | | | |
| | | | | | | | | current within a | | | | |
| | | | | | | | | time frame | | | | |
| | | | | | | | | specified by the | | | | |
| | | | | | | | | Relevant TSO which shall not be | | | | |
| | | | | | | | | less than 10 ms. | | | | |
| | | | | | | | | The target value of | | | | |
| | | | | | | | | this additional | | | | |
| | | | | | | | | reactive current | | | | |
| | | | | | | | | shall be reached | | | | |
| | | | | | | | | with an accuracy of 10% within 60 | | | | |
| | | | | | | | | ms from the | | | | |
| | | | | | | | | moment the | | | | |
| | | | | | | | | voltage deviation | | | | |
| | | | | | | | | has occurred as | | | | |
| | | | | | | | | further specified in | | | | |
| | | | | | | | | Article 15(2)(b)(1). | | | | |
| | | | | | | 1 | | The total Reactive | | | | |

| | TABLE 2 – GB Grid Code Comparison to ENTSO-E RfG | | | | | | | | | | | |
|-------------|--|-----|----------------|----------------------------|-----------------|-----------------------------------|--------------------|---|----------------------|--|--|--|
| Requirement | Plant | Key | GB | Power Station ⁻ | Гуре | ENTSO-E RfG– Generating Unit Type | | | | | | |
| • | Type | 2 | Large | Medium | Small | D | C | B | A | | | |
| | | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW_(GB) | 1 – 10 MW (GB) | <u>8</u> 400W – 1 MW | | | |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected | | | |
| | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV | | | |
| | | | (SHETL) | | | and subject to | subject to Article | subject to Article | | | | |
| | | | | | | Article 4(3) and | 4(3) and Article 3 | 4(3) and Article 3 | | | | |
| | | | | | | Article 6 (d) | <u>(6) (c)</u> | (6) (b) | | | | |
| | | | | | | | | Current | | | | |
| | | | | | | | | contribution shall be not more than | | | | |
| | | | | | | | | 1 p.u of the short | | | | |
| | | | | | | | | circuit dynamic | | | | |
| | | | | | | | | Current Rating | | | | |
| | | | | | | | | (covering up to 0.4 | | | | |
| | | | | | | | | seconds) of the | | | | |
| | | | | | | | | Power Park | | | | |
| | | | | | | | | Module or of the individual units of | | | | |
| | | | | | | | | the Power Park | | | | |
| | | | | | | | | Module taking into | | | | |
| | | | | | | | | account the pre- | | | | |
| | | | | | | | | fault reactive | | | | |
| | | | | | | | | Current. If | | | | |
| | | | | | | | | additional real | | | | |
| | | | | | | | | current injection is | | | | |
| | | | | | | | | given priority over additional reactive | | | | |
| | | | | | | | | Current injection | | | | |
| | | | | | | | | the total Current | | | | |
| | | | | | | | | contribution can | | | | |
| | | | | | | | | be further limited | | | | |
| | | | | | | | | by the real current | | | | |
| | | | | | | | | based on limiting | | | | |
| | | | | | | | | the apparent | | | | |
| | | | | | | | | current (is MVA limit) to 1p.u of the | | | | |
| | | | | | | | | short term | | | | |
| | | | | | | | | dynamic Current | | | | |
| | | | | | | | | Rating of the | | | | |
| | | | | | | | | Power Park | | | | |
| | | | | | | | | Module or the | | | | |

| | | | TABLI | E 2 – GB Grid Co | de Comparison | to ENTSO-E Rf | G | | |
|-------------|-------|-----|----------------|------------------|-----------------|-----------------------------------|--------------------|-----------------------------------|----------------------|
| Requirement | Plant | Key | GB | Power Station 1 | Гуре | ENTSO-E RfG Generating Unit Type | | | |
| | Type | 2 | Large | Medium | Small | D | C | B | A |
| | | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW_(GB) | 1 – 10 MW_(GB) | <u>8</u> 400W – 1 MW |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected |
| | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV |
| | | | (SHETL) | | | and subject to | subject to Article | subject to Article | |
| | | | | | | Article 4(3) and | 4(3) and Article 3 | 4(3) and Article 3 | |
| | | | | | | Article 6 (d) | (6) (c) | <u>(6) (b)</u> | |
| | | | | | | | | individual units of | |
| | | | | | | | | the Power Park | |
| | | | | | | | | Module. | |
| | | | | | | | | ii) The Relevant | |
| | | | | | | | | Network Operator | |
| | | | | | | | | in co-ordination | |
| | | | | | | | | with the Relevant | |
| | | | | | | | | TSO (whilst | |
| | | | | | | | | respecting the provisions of | |
| | | | | | | | | Article 4(3)) shall | |
| | | | | | | | | have the right to | |
| | | | | | | | | specify the | |
| | | | | | | | | requirements for | |
| | | | | | | | | fast acting | |
| | | | | | | | | additional reactive | |
| | | | | | | | | current during | |
| | | | | | | | | asymmetrical | |
| | | | | | | | | faults. Under the | |
| | | | | | | | | ENSO-E Code a | |
| | | | | | | | | specific new | |
| | | | | | | | | section has been | |
| | | | | | | | | included for Power | |
| | | | | | | | | Park Modules | |
| | | | | | | | | relating to reactive | |
| | | | | | | | | current injection | |
| | | | | | | | | during system | |
| | | | | | | | | faults. These are specified under | |
| | | | | | | | | Article 15 – 2. The | |
| | | | | | | | | requirements | |
| | | | | | | | | include:- | |
| | | | | | | | | moluue | |
| | | | | | | | | For a symmetrical | |

| TABLE 2 – GB Grid Code Comparison to ENTSO-E RfG | | | | | | | | | | | |
|--|-------|-----|----------------|-----------------|-----------------|------------------|--------------------|-----------------------|----------------------|--|--|
| Requirement | Plant | Key | GB | Power Station ' | Туре | E | NTSO-E RfG- Ge | enerating Unit Ty | pe | | |
| | Type | 2 | Large | Medium | Small | D | C | В | .A | | |
| | | | > 100 MW (E&W) | 50 - 100MW | < 50MW | > 30MW or | 30 – 10 MW (GB) | 1 – 10 MW_(GB) | <u>8</u> 400W – 1 MW | | |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected | | |
| | | | > 10 MW ` | SHÈTL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV | | |
| | | | (SHETL) | , | , , | and subject to | subject to Article | subject to Article | | | |
| | | | , , | | | Article 4(3) and | 4(3) and Article 3 | 4(3) and Article 3 | | | |
| | | | | | | Article 6 (d) | (6) (c) | (6) (b) | | | |
| | | | | | | | | three phase fault a | | | |
| | | | | | | | | Type B Power | | | |
| | | | | | | | | Park Module is | | | |
| | | | | | | | | required to | | | |
| | | | | | | | | i) Inject fast acting | | | |
| | | | | | | | | reactive current | | | |
| | | | | | | | | into the network at | | | |
| | | | | | | | | the Connection | | | |
| | | | | | | | | Point at no less | | | |
| | | | | | | | | than the red line | | | |
| | | | | | | | | shown in Figure 8 | | | |
| | | | | | | | | of Article 15- | | | |
| | | | | | | | | 2(a)(1). | | | |
| | | | | | | | | ii) As a minimum | | | |
| | | | | | | | | the reactive | | | |
| | | | | | | | | current supplied at | | | |
| | | | | | | | | the Power Park | | | |
| | | | | | | | | Module terminals | | | |
| | | | | | | | | shall contribute at | | | |
| | | | | | | | | least 2% of the | | | |
| | | | | | | | | rated current per | | | |
| | | | | | | | | percent of voltage | | | |
| | | | | | | | | deviation. | | | |
| | | | | | | | | iii) The Power | | | |
| | | | | | | | | Park Module shall | | | |
| | | | | | | | | be capable of | | | |
| | | | | | | | | feeding the | | | |
| | | | | | | | | required reactive | | | |
| | | | | | | | | current no later | | | |
| | | | | | | | | than 40ms after | | | |
| | | | | | | | | fault inception | | | |
| | | | | | | | | allowing the | | | |
| | | | | | | | 1 | voltage to be | | | |

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| | | | TABLE | ode Comparison | to ENTSO-E Rf | G | | | |
|-------------|-------|----------|-------|----------------------------|---------------|---|----------------|--|----|
| Requirement | Plant | Key | GB | Power Station ⁻ | Гуре | E | NTSO-E RfG- Ge | enerating Unit Ty | ре |
| • | Type | 2 | | Medium | Small | D | C | B | A |
| Requirement | | Key 2 | | Power Station ⁻ | Гуре | E | NTSO-E RfG- Ge | nerating Unit Ty B 1 - 10 MW (GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) measured at each Power Park Units terminals iv) The relevant Network Operator (pursuant to Article 4(3)) shall define in co-ordination with relevant TSO the parameter settings for the fast acting reactive current injection. v) If required the reactive current supply during the fault duration shall not be less than 1p.u of the short term dynamic rating of the equipment (>=1.0p.u) between 50% and 40% retained | _ |
| | | | | | | | | voltage (respectively in the case of a voltage drop between 50% and 60%) at the Connection Point. Below 40% retained voltage reactive current | |

| Type | | | 1., | | | ode Comparison | | | | |
|--|-------------|------|-----|----------------|------------|-----------------|------------------|--------------------|--------------------|---------------|
| Solid William Solid Willia | Requirement | | | GB | | | | | enerating Unit Ty | pe |
| > 30 MW (SPT) SHETL) < 30MW (SPT) connected at 110 KV or above and subject to Article 4(3) and Article 3 (6) (c) Shall be expired aside. Article 5 (d) Article 4 (3) and Article 3 (6) (c) Shall be expired aside. Article 5 (d) Article 5 (d) Shall be expired aside. In the Case of unbalanced faults the Relevant Network Operator in experiments pursuant to Article 4(3) will the Relevant Notwork Operator in experiments pursuant to Article 4(3) will appear to provide the provide the receive support necessary then if required by the Relevant Notwork Operator in experiments pursuant to Article 4(3) will all a Power Park Module fails to provide the Relevant Notwork Operator in experiments pursuant to Article 4(3) will all a Power Park Module fails to provide the Relevant Notwork Operator in experiments pursuant to Article 4(3) will all a Power Park Module fails to provide the Relevant TSO the Power Park Module causing the Network Operator in the Relevant Notwork Opera | | Type | 2 | Large Large | Medium | Small | D | C | L B | A |
| > 30 MW (SPT) SHETL) < 30 MW (SPT) connected at 110 kV or above and subject to Article 4(3) and Article 4(4) and Articl | | | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW_(GB) | 1 – 10 MW_(GB) | 8400W - 1 MW |
| (SHETL) and subject to Article 4(3) and Article 3 (6) (b) Article 6 (d) Article 8 (d) and Article 3 (d) and Article 3 (d) and Article 3 (e) and Article 4 (e) and Article 4 (e) and Article 6 (e) and Article 6 (e) and Article 6 (e) and Article 8 (e) and Article 9 (e) and Articl | | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | | and connected |
| Article 4(3) and Article 3 Article 6 (d) Article 4 (d) Article 6 (d) Article | | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV |
| Article 6 (d) Shall be supplied as far as technically feasible. Wij In the case of unbalanced faults the Relevant Network Operator in co-ordination with the Relevant TSO will specify the Reactive Current injection requirements pursuant to Article 4(3) Wij If a Power Park Module fails to provide the reactive support necessary then if required by the Relevant TSO the Power Park Module causing the Network Disturbance shall be disconnected | | | | (SHETL) | | | and subject to | subject to Article | | |
| shall-be supplied as far as technically feasible. vi) In the case of unbalanced faults the Relevant Network Operator in co-ordination with the Relevant TSO will specify the Reactive Current injection requirements pursuant to Article 4(3) vii) If a Power Park Module fails to provide the reactive support necessary then if required by the Relevant TSO the Power Park Module fails to provide the reactive support necessary then if required by the Relevant TSO the Power Park Module causing the Network | | | | | | | Article 4(3) and | 4(3) and Article 3 | 4(3) and Article 3 | |
| as far as technically feasible. vi) In the case of unbalanced faults the Relevant Network Operator in o-ordination with the Relevant TSO will specify the Reactive Current injection requirements pursuant to Article 4(3) vii) If a Power Park Module fails to provide the reactive support necessary then if required by the Relevant TSO the Power Park Module causing the Network Disturbance shall be disconnected | | | | | | | Article 6 (d) | (6) (c) | | |
| technically feasible. vi) In the case of unbalanced faults the Relevant Network Operator in co-ordination with the Relevant TSO will specify the Reactive Current injection requirements pursuant to Article 4(3) vii) If a Power Park Module faile to provide the reactive support necessary then if required by the Relevant TSO the Power Park Module causing the Network Disturbance shall be disconnected | | | | | | | | | | |
| feasible. vi) In the case of unbalaneed faults the Relevant Network Operator in co-ordination with the Relevant TSO will specify the Reactive Current injection requirements pursuant to Article 4(3) vii) If a Power Park Module fails to previde the reactive support necessary then if required by the Relevant TSO the Power Park Module causing the Network Disturbance shall be disconnected | | | | | | | | | | |
| vi) In the case of unbalanced faults the Relevant Network Operator in co-ordination with the Relevant TSO will specify the Reactive Current injection requirements pursuant to Article 4(3) vii) If a Power Park Module fails to provide the reactive support necessary then if required by the Relevant TSO the Power Park Module causing the Network Disturbance shall be disconnected | | | | | | | | | | |
| unbalanced faults the Relevant Network-Operator in co-ordination with the Relevant TSO-will specify the Reactive Current injection requirements pursuant to Article 4(3) vii) If a Power Park Module fails to provide the reactive support necessary then if required by the Relevant TSO the Power Park Module causing the Network Disturbance shall be disconnected | | | | | | | | | | |
| the Relevant Network Operator in co- ordination with the Relevant TSO will specify the Reactive Current injection requirements pursuant to Article 4(3) vii) If a Power-Park Medule fails to provide the reactive support necessary then if required by the Relevant TSO the Power Park Module causing the Network Disturbance shall be disconnected | | | | | | | | | | |
| Network Operator in co-ordination with the Relevant TSO will specify the Reactive Current injection requirements pursuant to Article 4(3) vii) If a Power-Park Module fails to provide the reactive support necessary then if required by the Relevant TSO the Power-Park Module causing the Network Disturbance shall be disconnected | | | | | | | | | | |
| in-co-ordination with the Relevant TSO will specify the Reactive Current injection requirements pursuant to Article 4(3) vii) If a Power Park Module fails to provide the reactive support necessary then if required by the Relevant TSO the Power Park Module causing the Network Disturbance shall be disconnected | | | | | | | | | | |
| with the Relevant TSO will specify the Reactive Current injection requirements pursuant to Article 4(3) vii) If a Power Park Modulo fails to provide the reactive support necessary then if required by the Relevant TSO the Power Park Module causing the Network Disturbance shall be disconnected | | | | | | | | | | |
| TSO will specify the Reactive Current injection requirements pursuant to Article 4(3) vii) If a Power Park Medule fails to provide the reactive support necessary then if required by the Relevant TSO the Power Park Module causing the Network Disturbance shall be disconnected | | | | | | | | | | |
| the Reactive Gurrent injection requirements pursuant to Article 4(3) vii) If a Power Park Module fails to provide the reactive support necessary then if required by the Relevant TSO the Power Park Module causing the Network Disturbance shall be disconnected | | | | | | | | | | |
| Current injection requirements pursuant to Article 4(3) vii) If a Power Park Module fails to provide the reactive support necessary then if required by the Relevant TSO the Power Park Module causing the Network Disturbance shall be disconnected | | | | | | | | | | |
| requirements pursuant to Article 4(3) vii) If a Power Park Module fails to provide the reactive support necessary then if required by the Relevant TSO the Power Park Module causing the Network Disturbance shall be disconnected | | | | | | | | | | |
| pursuant to Article 4(3) vii) If a Power Park Module fails to provide the reactive support necessary then if required by the Relevant TSO the Power Park Module causing the Network Disturbance shall be disconnected | | | | | | | | | | |
| 4(3) vii) If a Power Park Module fails to provide the reactive support necessary then if required by the Relevant TSO the Power Park Module causing the Network Disturbance shall be disconnected | | | | | | | | | | |
| vii) If a Power Park Module fails to provide the reactive support necessary then if required by the Relevant TSO the Power Park Module causing the Network Disturbance shall be disconnected | | | | | | | | | | |
| Module fails to provide the reactive support reactive support necessary then if required by the Relevant TSO the Power Park Module causing the Network Dieturbance shall be disconnected | | | | | | | | | | |
| provide the reactive support necessary then if required by the Relevant TSO the Power Park Module causing the Network Disturbance shall be disconnected | | | | | | | | | | |
| reactive support necessary then if required by the Relevant TSO the Power Park Module causing the Network Disturbance shall be disconnected | | | | | | | | | | |
| necessary then if required by the Relevant TSO the Power Park Module causing the Network Disturbance shall be disconnected | | | | | | | | | | |
| required by the Relevant TSO the Power Park Module causing the Network Disturbance shall be disconnected | | | | | | | | | | |
| Relevant TSO the Pewer Park Module causing the Network Disturbance shall be disconnected | | | | | | | | | | |
| Power Park Module causing the Network Disturbance shall be disconnected | | | | | | | | | | |
| Module causing the Network Disturbance shall be disconnected | | | | | | | | | | |
| the Network Disturbance shall be disconnected | | | | | | | | | | |
| Disturbance shall be disconnected | | | | | | | | | | |
| be disconnected | | | | | | | | | | |
| | | | 1 | | | | | | | |
| trom the Network | | | 1 | | | | | | | |
| | | | 1 | | | | | | | |
| after 0.5 seconds | | | | | | | | | | |
| if the positive | | | 1 | | | | | | | |
| phase sequence | | | 1 | | | | | | | |
| voltage at the connection point | | | 1 | | | | | | | |

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| | TABLE 2 – GB Grid Code Comparison to ENTSO-E RfG | | | | | | | | | | |
|--|--|-------------|--|---|---|--|---|---|--|--|--|
| Requirement | Plant | Key | GB | Power Station 7 | Гуре | Е | NTSO-E RfG- Ge | nerating Unit Ty | ре | | |
| | Type | 2 | Large Large | Medium | Small | D | | B | A | | |
| | | | > 100 MW (E&W) > 30 MW (SPT) > 10 MW (SHETL) | 50 – 100MW N/A (SPT / SHETL) | < 50MW < 30MW (SPT) < 10 MW (SHETL) | > 30MW or connected at 110kV or above and subject to Article 4(3) and Article 6 (d) | 30 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (c) | 1 – 10 MW (GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) | 8400W – 1 MW and connected below 110kV | | |
| | | | | | | | | falls and remains at a value of 85% or below the reference voltage (based on the highest phase voltage) and a resetting ratio of 0.98 and at the same time the direction of the Reactive Power at the connection point is reversed (ie into the Power Park Module). | | | |
| Operational Intertripping (GB CC.6.3.17) ENTSO-E — Article 87 — 1(fd) | Synchronous and Asynchronous | <u>2, 5</u> | Specified by NGET in the Bilateral Agreement depending upon whether this is required for thermal, voltage or stability reasons. | As per Large | Not applicable | As per Type A | As per Type A | As per Type A | Defined by Relevant Network Operator As per Article 78 - 1 (fel) whilst respecting the provisions of pursuant to Article 4(3). | | |
| Control Telephony and System Telephony GB CC.6.5.2 ENTSO-E Article 8 – (1)(f) and Article 9 – (2)(a)8 -4(b), Article 9 – | Synchronous and Asynchronous | <u>2, 9</u> | Control Telephony is a dedicated telephony service with a high level of redundancy and resilience and System Telephony | Only required for directly connected Medium Power Stations. For those Medium Power Stations which are | Only required for directly connected Small Power Stations. For those Small Power Stations which are | As per Type B | As pert Type BControl telephony is not specifically defined but is required in the context of instructions and communications | Not/Specifically defined but required in the context of an interface port to reduce Active Power export as detailed in Article | N/SNot specifically defined but required in the context of a logic interface port to cease Active Power export as | | |

| TABLE 2 – GB Grid Code Comparison to ENTSO-E RfG | | | | | | | | | | |
|--|------------------------------------|-----|--|--|---|--|---|---|--|--|
| Requirement | Plant | Key | GB | Power Station T | уре | Е | NTSO-E RfG- Ge | enerating Unit Ty | ре | |
| • | Type | 2 | Large | Medium | Small | D | | B | . | |
| | | | > 100 MW (E&W) > 30 MW (SPT) > 10 MW (SHETL) | 50 – 100MW N/A (SPT / SHETL) | < 50MW < 30MW (SPT) < 10 MW (SHETL) | > 30MW or connected at 110kV or above and subject to Article 4(3) and Article 6 (d) | 30 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (c) | 1 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) | 8400W – 1 MW and connected below 110kV | |
| 2(a) and Article 9 —5(2). | | | is based on the standard Public Telephone Provider (BT) Control Telephony is required for all Large Power Stations. If NGET consider Control telephony is not practicable then NGET will specify the use of System Telephony in the Bilateral Agreement | Embedded and SVA registered there is no requirement for Control or System Telephony For those Medium Power Stations which are CVA Registered and BM Participants there is a requirement for Control or System Telephony | Embedded and SVA registered there is no requirement for Control or System Telephony For those Small Power Stations which are CVA Registered and BM Participants there is a requirement for Control or System Telephony | | facilities (Article 8 —4(b)) and in respect of frequency stability and Black Start as defined in Article 9 —2(a) and Article 9—5(2) pursuant to Article 4(3). | 9 – (2)(a). Requirements for information exchange in real time are covered in Article 9 – (5)(d) | detailed in Article 8 – (1)(f). | |
| Operational Metering (GB CC.6.5.6 and CC.6.4.4 ENTSO-E Article 98 – 54(db). | Synchronous and Asynchronous | 2,9 | Generator to provide signals required by NGET in accordance with the terms of the Bilateral Agreement and NGET will then provide the communications routes to access the signals at the Transmission Interface Point as specified in the Bilateral | As specified by NGET in accordance with CC.6.5.6 and CC.6.4.4 | N/A | As per Type B | As per Type B | Specified by the Relevant Network Operator and Relevant TSO in accordance with Article 98 – 54(de) | N/S | |

| | TABLE 2 – GB Grid Code Comparison to ENTSO-E RfG | | | | | | | | | | | |
|---|--|-------------|---|---|---|--|--|---|--|--|--|--|
| Requirement | Plant | Key | GB | Power Station T | уре | Е | NTSO-E RfG- Ge | nerating Unit Type | ре | | | |
| • | Type | 2 | Large | Medium | Small | D | C | B | A | | | |
| | | | > 100 MW (E&W) > 30 MW (SPT) > 10 MW (SHETL) | 50 – 100MW N/A (SPT / SHETL) | < 50MW < 30MW (SPT) < 10 MW (SHETL) | > 30MW or connected at 110kV or above and subject to Article 4(3) and Article 6 (d) | 30 – 10 MW (GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (c) | 1 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) | 8400W – 1 MW and connected below 110kV | | | |
| Instructor Facilities including Fax Machines CC.6.5.7, CC.6.5.8 and CC.6.5.9 ENTSO-E Article 9 – 5(d), Article 10 – 2(a) and Article 10 – 6(d)8-4(b), Article 9 – 2(a) and Article 9 – 5(2) | Synchronous and Asynchronous | 2,9 | All BM Participants must have appropriate electronic data communication facilities to permit the submission of data as required by the Grid Code (EDT). In addition any Party that provides all Type 1 Ancillary Services and is a BM Participant shall be required to automatic logging facilities if they have a completion date after 1 January 2013. Each Generator is required to install | As per Large- Note the reference to BM Participants which has implications as to whether the plant is SVA or CVA registered. | N/A | As per type C | Instructor Facilities are not specifically defined but equivalent facilities are required under Article 9 – 5(d). Article 10 – (2)(a) (Active Power Control) and Article 10 – 6(d) (devices for additional system operation / security).8 – 4(b)) and in the context of instructions and communications facilities in respect of frequency stability and Black Start are required as defined in Article 9 – 2(a) and Article 9 – 5(2). | Instructor Facilities are not specifically defined but equivalent facilities are required under Article 9 – 5(d)N/S | N/S | | | |
| Dynamic System Monitoring, Quality of Supply Monitoring and Ancillary Services Monitoring | Synchronous and Asynchronous | <u>2, 5</u> | a Fax Machine The requirements for Dynamic System Monitoring are specified by NGET in the | As per Large – Note however some of these requirements vary depending on whether the Plant | Not specified | As per Type C | For Dynamic System monitoring, Fault Recording and Quality of Supply Monitoring the | N/S | N/S | | | |

Bold

| | TABLE 2 – GB Grid Code Comparison to ENTSO-E RfG | | | | | | | | | | |
|--|--|-----|---|------------------------------------|---|--|--|---|--|--|--|
| Requirement | Plant | Key | GB | Power Station ⁻ | Туре | Е | NTSO-E RfG- Ge | nerating Unit Ty | pe | | |
| [| Type | 2 | Large | Medium | Small | D | C | B | A | | |
| | | | > 100 MW (E&W) > 30 MW (SPT) > 10 MW (SHETL) | 50 – 100MW N/A (SPT / SHETL) | < 50MW < 30MW (SPT) < 10 MW (SHETL) | > 30MW or connected at 110kV or above and subject to Article 4(3) and Article 6 (d) | 30 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (c) | 1 – 10 MW (GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) | 8400W – 1 MW and connected below 110kV | | |
| GB CC.6.5.6, CC.6.1.6 and OC 5.4.1 (c) ENTSO-E Article 10 – (2)(f) and Article 10(6)(b)(9 –6) (e), Article 9 –(6)(j) and Article 9 – 2(g). | | | Bilateral Agreement Note requirements for Ancillary Services Monitoring and Quality of Supply Monitoring are also defined by NGET in the Bilateral Agreement | is SVA or CVA Registered. | | | requirements are defined Article 109 – 6)(be)(1), (2), (3) and (4) and Article 9-6)(1). The signals required shall include Voltage, Active Power, Reactive Power, Reactive Power, Reactive Power and, Frequency and Harmonies. The Relevant Network Operator (whilst respecting the provisions of pursuant to Article 4(3)) shall have the right to add other quality of supply parameters provided reasonable notice is given. The settings, triggering, sample rates, parameters, interfacing arrangements and data submission of the monitoring / fault recording equipment shall | | | | |

| | TABLE 2 – GB Grid Code Comparison to ENTSO-E RfG | | | | | | | | | | | | |
|-------------|--|-----|---------------------------------|--------------------------|------------------------|--------------------------------|---|------------------------------------|-------------------------------|--|--|--|--|
| Requirement | Plant | Key | GB | Power Station | Туре | Е | NTSO-E RfG- Ge | nerating Unit Ty | pe | | | | |
| • | Type | 2 | Large Large | Medium | Small | D | C | B | A | | | | |
| | | | > 100 MW (E&W) > 30 MW (SPT) | 50 – 100MW N/A (SPT / | < 50MW < 30MW (SPT) | > 30MW or connected at | 30 – 10 MW (GB) and connected | 1 – 10 MW_(GB) and connected | 8400W - 1 MW and connected | | | | |
| | | | > 10 MW (SHETL) | SHETL) | < 10 MW (SHETL) | 110kV or above and subject to | below 110kV and subject to Article | below 110kV and subject to Article | below 110kV | | | | |
| | | | (0::=:=) | | | Article 4(3) and Article 6 (d) | 4(3) and Article 3 (6) (c) | 4(3) and Article 3 (6) (b) | | | | | |
| | | | | | | Article o (u) | be agreed with the | (0) (0) | | | | | |
| | | | | | | | Relevant Network Operator and | | | | | | |
| | | | | | | | Relevant TSO | | | | | | |
| | | | | | | | whilst respecting the provisions of | | | | | | |
| | | | | | | | pursuant to Article | | | | | | |
| | | | | | | | 4(3)). | | | | | | |
| | | | | | | | For Frequency Response | | | | | | |
| | | | | | | | monitoring (le | | | | | | |
| | | | | | | | Ancillary Services Modelling in GB | | | | | | |
| | | | | | | | terms) the | | | | | | |
| | | | | | | | requirements are defined under | | | | | | |
| | | | | | | | Article <u>10</u> 9 – (2)(cg)(f) The | | | | | | |
| | | | | | | | communication | | | | | | |
| | | | | | | | interface shall be equipped to | | | | | | |
| | | | | | | | transfer on line | | | | | | |
| | | | | | | | from the Generator to the | | | | | | |
| | | | | | | | <u>Network</u> Operator's / TSO's | | | | | | |
| | | | | | | | Control Centre at | | | | | | |
| | | | | | | | <u>least the</u> Network Operator and TSO | | | | | | |
| | | | | | | | can request the following signals | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | Status signal of | | | | | | |

| | TABLE 2 – GB Grid Code Comparison to ENTSO-E RfG | | | | | | | | | | | |
|-------------|--|----------|----|-----------------|-------|---|---|--|----|--|--|--|
| Requirement | Plant | Key | GB | Power Station ' | Туре | Е | NTSO-E RfG- Ge | enerating Unit Ty | pe | | | |
| ' | Type | 2 | | Medium | Small | D | C | B | A | | | |
| Requirement | | Key 2 | | Power Station | Туре | Е | NTSO-E RfG- Ge | enerating Unit Ty B 1 – 10 MW (GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) | | | | |
| | | | | | | | shall define the additional signals to be provided by the Power Generating Facility in order to verify performance of the Active Power Frequency Response of those participating Power Generating Modules. point value fre frequency response Droop and | | | | | |

| TABLE 2 – GB Grid Code Comparison to ENTSO-E RfG | | | | | | | | | |
|--|------------------------------------|----------|--|---|---|--|--|---|---|
| Requirement | Plant | Key | GB | Power Station T | уре | Е | NTSO-E RfG- Ge | nerating Unit Ty | ре |
| • | Type | 2 | Large | Medium | Small | D | C | B | . A |
| | | | > 100 MW (E&W) > 30 MW (SPT) > 10 MW (SHETL) | 50 – 100MW N/A (SPT / SHETL) | < 50MW < 30MW (SPT) < 10 MW (SHETL) | > 30MW or connected at 110kV or above and subject to Article 4(3) and Article 6 (d) | 30 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (c) | 1 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) | 8400W – 1 MW and connected below 110kV |
| | | | | | | | deadband and for Power Park Modules available power reflecting maximum unrestricted power taking into account variable source of primary power—ie wind or solar. | | |
| Safety Related Conditions CC.7 | Synchronous and Asynchronous | <u>9</u> | Captured under CC.7 and applies to directly Connected Plant | As per Large | As per Large | N/S | N/S | N/S | N/S |
| Ancillary Services CC.8 | Synchronous and Asynchronous | 9 | Defines the Mandatory Ancillary Services (Part I) and (Part II) that Generators are required to provide. For Part 1 Ancillary Services (Frequency response – in general required from Large Power Stations except those which are | As per Large except in the case of Licence Exempt Embedded Medium Power Stations where they are not applicable | N/A | Specified through the obligations on Type D Units (including the specific requirements for Synchronous Power Generating Modules Units and Power Park Modules | Specified through the obligations on Type C Units (including the specific requirements for Synchronous Power Generating ModulesUnits and Power Park Modules | Specified through the obligations on Type B Units (including the specific requirements for Synchronous Power Generating ModulesUnits and Power Park Modules | Specified through the obligations on Type A Units (including the specific requirements for Synchronous Power Generating ModulesUnits and Power Park Modules |

| | | | TABLE | 2 – GB Grid Co | ode Comparison | | | | |
|-------------|-------|-----|--|------------------------------------|---|--|--|---|--|
| Requirement | Plant | Key | GB I | Power Station 1 | Гуре | E | NTSO-E RfG- Ge | nerating Unit Ty | ре |
| - | Type | 2 | Large | Medium | Small | D | C | B | A |
| | | | > 100 MW (E&W) > 30 MW (SPT) > 10 MW (SHETL) | 50 – 100MW N/A (SPT / SHETL) | < 50MW < 30MW (SPT) < 10 MW (SHETL) | > 30MW or connected at 110kV or above and subject to Article 4(3) and Article 6 (d) | 30 – 10 MW (GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (c) | 1 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) | 8400W – 1 MW and connected below 110kV |
| | | | less than 50MW and comprise Power Park Modules and Reactive Capability required from Large and Medium Power Stations. In terms of Part II Ancillary Services such as Frequency Control, Black Start and Operational intertripping these are defined by NGET in the Bilateral Agreement. Commercial Ancillary Services are those over and above the minimum requirements which are agreed | | | Article 6 (d) | (6) (c) | <u>(6) (b)</u> | |
| | | | by NGET and the User and dealt with under the terms of the | | | | | | |

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| TABLE 2 – GB Grid Code Comparison to ENTSO-E RfG | | | | | | | | | | |
|--|------------------------------------|-----|--|---|---|--|--|---|--|--|
| Requirement | Plant | Key | GB | Power Station T | ype | Е | NTSO-E RfG- Ge | nerating Unit Ty | ре | |
| • | Type | 2 | Large | Medium | Small | D | C | B | A | |
| | | | > 100 MW (E&W) > 30 MW (SPT) > 10 MW (SHETL) | 50 – 100MW N/A (SPT / SHETL) | < 50MW < 30MW (SPT) < 10 MW (SHETL) | > 30MW or connected at 110kV or above and subject to Article 4(3) and Article 6 (d) | 30 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (c) | 1 – 10 MW (GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) | 8400W – 1 MW and connected below 110kV | |
| | | | Ancillary Services Agreement | | | | | | | |
| Performance when operating in Limited Frequency Sensitive Mode for Over frequencies (BC.3.7.2 and Article 87 - 1(c). | Synchronous and Asynchronous | 5 | Requires all Large Generating units that are obliged to meet the requirements of the Balancing Codes to automatically de- load at a rate of at least 2 percent of output per 0.1 Hz deviation of System Frequencies above 50.4 Hz. | Required if the Medium Power Station is only required to meet the requirements of the Balancing Codes | Not applicable | As per Type A | As per Type A | As per Type A | Each Power Generating ModuleUnit shall be capable of activating the provision of Active Power Frequency Response at according to Figure 1 defined in Article 78 – (1)(c)(1). The Power Generating Moduleunit shall in Limited frequency Sensitive Mode overfrequency be capable of activating Active Power Frequency Response at a frequency Response at a frequency threshold between and including 50.2Hz and 50.5Hz with a droop in a range of 2 – 12 | |

| | TABLE 2 – GB Grid Code Comparison to ENTSO-E RfG | | | | | | | | | | | |
|-------------|--|-----|---|------------------------------------|---|--|--|---|--|--|--|--|
| Requirement | Plant | Key | GB | Power Station | Туре | ENTSO-E RfG Generating Unit Type | | | | | | |
| | Type | 2 | Large | Medium | Small | D | C | B | A | | | |
| | | | > 100 MW (E&W) > 30 MW (SPT) > 10 MW (SHETL) | 50 – 100MW N/A (SPT / SHETL) | < 50MW < 30MW (SPT) < 10 MW (SHETL) | > 30MW or connected at 110kV or above and subject to Article 4(3) and Article 6 (d) | 30 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (c) | 1 – 10 MW (GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) | 8400W – 1 MW and connected below 110kV | | | |
| | | | | | | | | | %. The actual Frequency threshold and droop settings shall be determined by the Relevant TSO. The | | | |
| | | | | | | | | | Power Generating Module shall be capable of activating Active Power Frequency | | | |
| | | | | | | | | | Response shall be activated as fast as technically feasible with an initial delay that shall be as short | | | |
| | | | | | | | | | as possible and reasonably justified iby the Power Generating Facility Owner to the Relevant | | | |
| | | | | | | | | | TSO if f greater than 2 seconds. The Power Generating Module shall be | | | |

| | | | TABLE | ode Comparison | on to ENTSO-E RfG | | | | |
|-------------|-------|-----|---|------------------------------------|---|--|--|---|--|
| Requirement | Plant | Key | GB | Power Station | Туре | Е | NTSO-E RfG- Ge | nerating Unit Ty | ре |
| | Type | 2 | Large | Medium | Small | D | C | B | A |
| | | | > 100 MW (E&W) > 30 MW (SPT) > 10 MW (SHETL) | 50 – 100MW N/A (SPT / SHETL) | < 50MW < 30MW (SPT) < 10 MW (SHETL) | > 30MW or connected at 110kV or above and subject to Article 4(3) and Article 6 (d) | 30 – 10 MW (GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (c) | 1 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) | 8400W – 1 MW and connected below 110kV |
| | | | | | | | | 35.151 | capable of either continuing operation at its minimum regulating level when reaching it or further decreasing Active Power output in this case as defined by the Relevant TSO while respecting the provisions of Article 4(3). The Power Generating Module shall be Stable operation of the Generating Unit during LFSM-O operation. When LFSM-O is active the LFSM-O setpoint will prevail over any other Active Power Setpoints. shall be ensured. Any contradiction between LFSM-O sepeed Control |

| | | | | | ode Comparison | | | | | | |
|---------------------------------------|--------------|-------------|----------------|---------------|-----------------|------------------------------------|--|--|---------------------------------|---|----------------------------|
| Requirement | Plant | Key | GB | Power Station | | | NTSO-E RfG- Ge | enerating Unit Ty | pe | | |
| | Type | 2 | Large Large | Medium | Small | D | C | В | . | | Formatted: Font: 8 pt, Not |
| | | | > 100 MW (E&W) | 50 - 100MW | < 50MW | > 30MW or | 30 – 10 MW (GB) | 1 – 10 MW (GB) | 8400W - 1 MW | | Bold |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected | | |
| | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV | | |
| | | | (SHETL) | | | and subject to Article 4(3) and | subject to Article 4(3) and Article 3 | subject to Article 4(3) and Article 3 | | | |
| | | | | | | Article 6 (d) | (6) (c) | (6) (b) | | | |
| | | | | | | 1111010 0 (0) | 107 (0) | (0) (0) | and Power | | |
| | | | | | | | | | Control during | | |
| | | | | | | | | | LFSM-O | | |
| | | | | | | | | | operation shall be avoided. | | |
| Performance | Synchronous | <u>2, 6</u> | | Not required | Not required | As per Type C | Each Power | N/S | be avoided. N/S ◀ | | (- |
| when operating in | and | <u>2, 0</u> | Not required | Not required | Not required | 713 per Type o | Generating | 14/0 | 14/0 | | Formatted: Left |
| Limited | Asynchronous | | Not required | | | | Module Unit shall | | | | |
| Frequency | | | | | | | be capable of | | | | |
| Sensitive Mode | | | | | | | activating the | | | | |
| for under frequencies | | | | | | | provision ofproviding Active | | | | |
| ENTSO-E Article | | | | | | | Power Frequency | | | | |
| <u>109</u> – <u>(</u> 2)(<u>b</u> e) | | | | | | | response | | | | |
| | | | | | | | according to | | | | |
| | | | | | | | Figure 4 as | | | | |
| | | | | | | | described in Article 10 – (2)(b) | | | | |
| | | | | | | | at a Frequency | | | | |
| | | | | | | | threshold between | | | | |
| | | | | | | | 49.8 and 49.5 Hz | | | | |
| | | | | | | | with a droop in a | | | | |
| | | | | | | | range of 2 – 12%. | | | | |
| | | | | | | | In the LFSM –U Mode the Power | | | | |
| | | | | | | | Generating | | | | |
| | | | | | | | Module shall be | | | | |
| | | | | | | | capable of | | | | |
| | | | | | | | providing a power | | | | |
| | | | | | | | increase up to its maximum | | | | |
| | | | | | | | capacity. The | | | | |
| | | | | | | | actual delivery of | | | | |
| | | | | | | | Active Power | | | 1 | |

| | | | TABLI | E 2 – GB Grid Co | de Comparison | to ENTSO-E Rf | G | | |
|-------------|-------|-----|----------------|------------------|-----------------|------------------|------------------------------|--------------------|----------------------|
| Requirement | Plant | Key | GB | Power Station 1 | Гуре | Е | NTSO-E RfG- Ge | nerating Unit Ty | pe |
| | Type | 2 | Large | Medium | Small | D | C | B | A |
| | | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW (GB) | 1 – 10 MW_(GB) | <u>8</u> 400W – 1 MW |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected |
| | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV |
| | | | (SHETL) | | | and subject to | subject to Article | subject to Article | |
| | | | | | | Article 4(3) and | 4(3) and Article 3 | 4(3) and Article 3 | |
| | | | | | | Article 6 (d) | (6) (c) | <u>(6) (b)</u> | |
| | | | | | | | Frequency | | |
| | | | | | | | Response in LFSM – U mode | | |
| | | | | | | | 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 | | |
| | | | | | | | (Article 8 – (1) and | | |
| | | | | | | | available primary | | |
| | | | | | | | energy sources. | | |
| | | | | | | | The actual | | |
| | | | | | | | frequency | | |
| | | | | | | | threshold and | | |
| | | | | | | | droop settings shall be | | |
| | | | | | | | determined by the | | |
| | | | | | | | Relevant TSO. | | |
| | | | | | | | The Active Power | | |
| | | | | | | | frequency | | |
| | | | | | | | response shall be | | |
| | | | | | | | activated as fast | | |
| | | | | | | | as technically | | |
| | | | | | | | feasible with an | | |
| | | | | | | | initial delay as | | |
| | | | | 1 | | | short as possible | 1 | |

| | | 1 | | | ode Comparison t | | | | | |
|-------------|-------|-----|----------------|---------------|------------------|------------------|----------------------------------|--------------------|----------------------|--------------------------------|
| Requirement | Plant | Key | GB | Power Station | | E | NTSO-E RfG- Ge | | ре | |
| | Type | 2 | Large Large | Medium | Small | D | C | B | | Formatted: Font: 8 pt, Not |
| | | | > 100 MW (E&W) | 50 - 100MW | < 50MW | > 30MW or | 30 – 10 MW (GB) | 1 – 10 MW (GB) | <u>8</u> 400W – 1 MW | Bold |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected | |
| | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV | |
| | | | (SHETL) | | | and subject to | subject to Article | subject to Article | | |
| | | | | | | Article 4(3) and | 4(3) and Article 3 | 4(3) and Article 3 | | |
| | | | | | | Article 6 (d) | (6) (c) | <u>(6) (b)</u> | | |
| | | | | | | | and justified by the | | | |
| | | | | | | | Generator to the | | | |
| | | | | | | | Relevant TSO if greater than 2 | | | |
| | | | | | | | | | | |
| | | | | | | | seconds. | | | |
| | | | | | | | Stable operation | | | |
| | | | | | | | of the Power | | | |
| | | | | | | | Generating | | | |
| | | | | | | | Module during | | | |
| | | | | | | | LFSM-U shall be | | | |
| | | | | | | | ensured and 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. | | | (<u> </u> |
| | | | | | | | Sensitive Mode | | + | Formatted: All caps |
| | | | | | | | - Under | | | |
| | | | | | | | Frequency (LFSM- | | | |
| | | | | | | | U) in accordance | | | |
| | | | | | | | with Figure 2 as | | | |
| | | | | | | | defined in Article 9 | | | |
| | | | | | | | -2)(c)(1). The | | | |
| | | | | | | | Generating Unit | | | |
| | | | | | | | shall in the LFSM- | | | |
| | | | | | | | U mode be | | | |
| | | | | | | | capable of | | | |

| | TABLE 2 – GB Grid Code Comparison to ENTSO-E RfG | | | | | | | | | | | |
|-------------|--|-----|----------------|---------------|-----------------|------------------|---------------------------------------|--------------------|---------------|--|--|--|
| Requirement | Plant | Key | GB | Power Station | Type | Е | NTSO-E RfG- Ge | enerating Unit Ty | pe | | | |
| • | Type | 2 | Large | Medium | Small | D | C | B | A | | | |
| | | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW (GB) | 1 – 10 MW (GB) | 8400W - 1 MW | | | |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected | | | |
| | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV | | | |
| | | | (SHETL) | | | and subject to | subject to Article | subject to Article | | | | |
| | | | | | | Article 4(3) and | 4(3) and Article 3 | 4(3) and Article 3 | | | | |
| | | | | | | Article 6 (d) | (6) (c) | <u>(6) (b)</u> | | | | |
| | | | | | | | activating Active | | | | | |
| | | | | | | | Power Frequency | | | | | |
| | | | | | | | Response at a | | | | | |
| | | | | | | | frequency | | | | | |
| | | | | | | | threshold between | | | | | |
| | | | | | | | 49.8Hz and 49.5 | | | | | |
| | | | | | | | Hz with a droop in | | | | | |
| | | | | | | | a range of 2 – | | | | | |
| | | | | | | | 12% by providing | | | | | |
| | | | | | | | a power increase up to its maximum | | | | | |
| | | | | | | | capacity taking | | | | | |
| | | | | | | | account of | | | | | |
| | | | | | | | limitations for | | | | | |
| | | | | | | | some generation | | | | | |
| | | | | | | | technologies from | | | | | |
| | | | | | | | operation near | | | | | |
| | | | | | | | maximum capacity | | | | | |
| | | | | | | | at low frequencies. | | | | | |
| | | | | | | | The Active Power | | | | | |
| | | | | | | | Frequency | | | | | |
| | | | | | | | Response shall be | | | | | |
| | | | | | | | as fast as | | | | | |
| | | | | | | | technically feasible | | | | | |
| | | | | | | | with an initial delay | | | | | |
| | | | | | | | that shall be as | | | | | |
| | | | | | | | short as possible | | | | | |
| | | | | | | | and reasonably | | | | | |
| | | | | | | | justified if greater | | | | | |
| | | | | | | | than 2 seconds. | | | | | |
| | | | | | | | Stable operation | | | | | |
| | | | | | | | of the Generating | | | | | |
| | | | | | | | Unit during LFSM | | | | | |
| | | | | | | | U operation shall | | | | | |

| | | | TABLE | E 2 – GB Grid Co | de Comparison t | to ENTSO-E Rf | G | | |
|---|-------------|-----|--|------------------------------------|---|--|--|---|--|
| Requirement | Plant | Key | | Power Station 1 | | | | enerating Unit Ty | ре |
| • | Type | 2 | Large | Medium | Small | D | C | B | A |
| | | | > 100 MW (E&W) > 30 MW (SPT) > 10 MW (SHETL) | 50 – 100MW N/A (SPT / SHETL) | < 50MW < 30MW (SPT) < 10 MW (SHETL) | > 30MW or connected at 110kV or above and subject to Article 4(3) and Article 6 (d) | 30 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (c) | 1 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) | 8400W – 1 MW and connected below 110kV |
| Compliance ENTSO-E – Articles 24 - 51 | Synchronous | ? | Work is currently underway to include Compliance issues in the Grid Code. At the present time the requirements are defined in Guidance notes for Synchronous Generators, issue | As per Large | N/A | Covered under Articles 24 – 51 as applicable | be ensured. Any contraction between power and speed control during Limited Frequency Sensitive Mode (underfrequency) shall be prohibited. When in LFSM-U operation the Generating Unit will also simultaneously be in LFSM-O Mode. Covered under Articles 24 – 51 as applicable | Covered under Articles 24 – 51 as applicable | Covered under Articles 24 – 51 as applicable |

| | | | TABLE | E 2 – GB Grid C | ode Comparison | son to ENTSO-E RfG | | | | |
|--|------------------------------------|---------------|--|------------------------------------|---|--|--|---|--|--|
| Requirement | Plant | Key | GB | Power Station | Туре | E | NTSO-E RfG- Ge | enerating Unit Ty | ре | |
| | Type | 2 | Large | Medium | Small | D | C | B | A | |
| | | | > 100 MW (E&W) > 30 MW (SPT) > 10 MW (SHETL) | 50 – 100MW N/A (SPT / SHETL) | < 50MW < 30MW (SPT) < 10 MW (SHETL) | > 30MW or connected at 110kV or above and subject to Article 4(3) and Article 6 (d) | 30 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (c) | 1 – 10 MW (GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) | 8400W – 1 MW and connected below 110kV | |
| | | | OC 5 | | | | | | | |
| Compliance ENTSO-E – Articles 24 - 51 | Asynchronous | ? | Work is currently underway to include Compliance issues in the Grid Code. At the present time the requirements are defined in Guidance notes for Power Park Developers, issue 2 which is available from NGET's website. Re testing is captured under OC 5 | As per Large | N/A | Covered under Articles 24 – 51 as applicable | Covered under Articles 24 – 51 as applicable | Covered under Articles 24 – 51 as applicable | Covered under Articles 24 – 51 as applicable | |
| Data / Models GB Planning Code (PC) Article 109 – (6)(cf). | Synchronous and Asynchronous | 2. 4. 5. 9 | Detailed Modelling Data is required under different time phases under the Grid Code Planning Code depending upon the type of plant and whether or not it is a Large Medium or Small Generator. There | As per Large | As per Large | As per Type C | Each Relevant Network Operator in coordination with the relevant TSO (has the right to define (whilst respecting the provisions of pursuant to Article 4(3)) shall have the right to require simulation models that shall properly | N/S | N/S | |

| | | | TABLE | E 2 – GB Grid Co | de Comparison t | o ENTSO-E Rf | G | | |
|-------------|-------|-----|-------------------|------------------|-----------------|-----------------------------------|-----------------------------------|-------------------------------|----------------------|
| Requirement | Plant | Key | GB | Power Station 1 | уре | E | NTSO-E RfG- Ge | nerating Unit Ty | ре |
| • | Type | 2 | Large | Medium | Small | D | C | B | A |
| | | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW_(GB) | 1 – 10 MW (GB) | <u>8</u> 400W – 1 MW |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected |
| | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV |
| | | | (SHETL) | | | and subject to | subject to Article | subject to Article | |
| | | | | | | Article 4(3) and Article 6 (d) | 4(3) and Article 3 (6) (c) | 4(3) and Article 3 (6) (b) | |
| | | | is no requirement | | | Article 6 (u) | reflect the | <u>(0) (D)</u> | |
| | | | for model data to | | | | behaviour of the | | |
| | | | be submitted | | | | Power Generating | | |
| | | | under the | | | | Module Unit in both | | |
| | | | Connection | | | | steady state and | | |
| | | | Conditions | | | | dynamic | | |
| | | | | | | | simulations and | | |
| | | | | | | | where appropriate and justified | | |
| | | | | | | | electromagnetic | | |
| | | | | | | | transient | | |
| | | | | | | | simulations. The | | |
| | | | | | | | requirement for | | |
| | | | | | | | simulation models | | |
| | | | | | | | shall include the format in which | | |
| | | | | | | | models they shall | | |
| | | | | | | | be provided and | | |
| | | | | | | | the provision of | | |
| | | | | | | | documentation of | | |
| | | | | | | | the model | | |
| | | | | | | | structure and block diagrams. | | |
| | | | | | | | The models shall | | |
| | | | | | | | be verified against | | |
| | | | | | | | the results of | | |
| | | | | | | | compliance tests | | |
| | | | | | | | as of Title 4 | | |
| | | | | | | | Chapters 5, 6 and | | |
| | | | | | | | 7 and for use in studies for | | |
| | | | | | | | continuous | | |
| | | | | | | | evaluation in | | |
| | | | | | | | system planning | | |

| TABLE 2 – GB Grid Code Comparison to ENTSO-E RfG | | | | | | | | | | | | |
|--|-------|-----|---|------------------------------------|---|--|---|---|--|--|--|--|
| Requirement | Plant | Key | GB | Power Station ' | Туре | ENTSO-E RfG Generating Unit Type | | | | | | |
| • | Type | 2 | Large | Medium | Small | D | C | B | A | | | |
| | | | > 100 MW (E&W) > 30 MW (SPT) > 10 MW (SHETL) | 50 – 100MW N/A (SPT / SHETL) | < 50MW < 30MW (SPT) < 10 MW (SHETL) | > 30MW or connected at 110kV or above and subject to Article 4(3) and Article 6 (d) | 30 – 10 MW (GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (c) | 1 – 10 MW (GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) | 8400W – 1 MW and connected below 110kV | | | |
| | | | | | | | and operation. for the purpose of verification of the requirements of this Network Code and for the use in all studies for continuous evaluation in system planning and operation. | | | | | |
| | | | | | | | For the purpose of dynamic simulations the models provided shall contain the following submodels depending on the existence of the mentioned components | | | | | |
| | | | | | | | Alternator and prime mover Speed and power control Voltage control including PSS functionality (if applicable) and excitation system and limiters | | | | | |

| | TABLE 2 – GB Grid Code Comparison to ENTSO-E RfG | | | | | | | | | | | |
|-------------|--|-----|----------------|---------------|-----------------|-----------------------------------|------------------------------------|--------------------|----------------------|--|--|--|
| Requirement | Plant | Key | GB | Power Station | Туре | ENTSO-E RfG Generating Unit Type | | | | | | |
| • | Type | 2 | Large | Medium | Small | D | C | B | A | | | |
| | | | > 100 MW (E&W) | 50 - 100MW | < 50MW | > 30MW or | 30 – 10 MW_(GB) | 1 – 10 MW_(GB) | <u>8</u> 400W – 1 MW | | | |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected | | | |
| | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV | | | |
| | | | (SHETL) | | | and subject to | subject to Article | subject to Article | | | | |
| | | | | | | Article 4(3) and | 4(3) and Article 3 | 4(3) and Article 3 | | | | |
| | | | | | | Article 6 (d) | (6) (c) Power Generating | <u>(6) (b)</u> | | | | |
| | | | | | | | Module Unit | | | | | |
| | | | | | | | protection models | | | | | |
| | | | | | | | as agreed with the | | | | | |
| | | | | | | | relevant Network | | | | | |
| | | | | | | | Operator and | | | | | |
| | | | | | | | Power Generating | | | | | |
| | | | | | | | Facility Owner | | | | | |
| | | | | | | | (whilst respecting | | | | | |
| | | | | | | | the provisions | | | | | |
| | | | | | | | pursuant tof Article 4(3)) and | | | | | |
| | | | | | | | Converter Models | | | | | |
| | | | | | | | for Power Park | | | | | |
| | | | | | | | Modules_ | | | | | |
| | | | | | | | The Relevant | | | | | |
| | | | | | | | Network Operator | | | | | |
| | | | | | | | shall provide an | | | | | |
| | | | | | | | estimate of the | | | | | |
| | | | | | | | maximum and | | | | | |
| | | | | | | | minimum short | | | | | |
| | | | | | | | circuit capacity at the Connection | | | | | |
| | | | | | | | Point expressed in | | | | | |
| | | | | | | | MVA, as an | | | | | |
| | | | | | | | equivalent of the | | | | | |
| | | | | | | | Network. | | | | | |
| | | | | | | | The Relevant | | | | | |
| | | | | | | | Network Operator | | | | | |
| | | | | | | | or Relevant TSO | | | | | |
| | | | | | | | (whilst respecting | | | | | |
| | | | | | | | the provisions of | | | | | |

| | | | TABLE | to ENTSO-E RfG | | | | | |
|--|------------------------------------|-----|---|------------------------------------|---|--|--|---|--|
| Requirement | Plant | Key | GB | Power Station | Туре | ENTSO-E RfG Generating Unit Type | | | |
| • | Type | 2 | Large | Medium | Small | D | C | B | A |
| | | | > 100 MW (E&W) > 30 MW (SPT) > 10 MW (SHETL) | 50 – 100MW N/A (SPT / SHETL) | < 50MW < 30MW (SPT) < 10 MW (SHETL) | > 30MW or connected at 110kV or above and subject to Article 4(3) and Article 6 (d) | 30 – 10 MW (GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (c) | 1 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) | 8400W – 1 MW and connected below 110kV |
| | | | | | | | pursuant to Article 4(3)) shall have the right to require Power Generating Module Unit recordings in order to compare the response of the models with these recordings. | | |
| Synchronisation In GB covered under the site specific Bilateral Agreement under Appendix F3 and Relevant Electrical Standards). (ENTSO-E – Article 109 – 56(ca)) and Article 11 – (4). | Synchronous and Asynchronous | | For directly connected plant specified in the site specific Bilateral Agreement and referenced in the Relevant Electrical Standards N/A for Embedded Plant | As per Large | As per Large | Synchronisation shall be performed by the Generator after authorisation by the Relevant Network Operator. The Power Generating Module shall be equipped with the necessary synchronisation facilities. Synchronisation of Power Generating Modules shall be possible for frequencies within the ranges specified | N/S other than in respect of quick re-sycnhronisation as detailed in Article 10 – (5)(c). Generating Unit synchronisation shall be performed by the Power Generating facility owner equipped with the necessary synchronisation facilities. The Generating Unit shall be equipped with the necessary synchronisation facilities. Synchronisation of Generating Units shall be possible for frequencies within the ranges | N/S | N/S |

| | TABLE 2 – GB Grid Code Comparison to ENTSO-E RfG | | | | | | | | |
|----------------------------|--|-------------|---|------------------------------------|---|--|--|---|--|
| Requirement | Plant | Key | Key GB Power Station Type ENTSO-E RfG- Gene | | | nerating Unit Ty | ре | | |
| • | Type | 2 | Large | Medium | Small | D | C | B | . |
| | | | > 100 MW (E&W) > 30 MW (SPT) > 10 MW (SHETL) | 50 – 100MW N/A (SPT / SHETL) | < 50MW < 30MW (SPT) < 10 MW (SHETL) | > 30MW or connected at 110kV or above and subject to Article 4(3) and Article 6 (d) in Table 2. The | 30 – 10 MW_(GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (c) specified in Table | 1 – 10 MW (GB) and connected below 110kV and subject to Article 4(3) and Article 3 (6) (b) | 8400W – 1 MW and connected below 110kV |
| | | | | | | Relevant Network Operator and the Power Generating Facility Owner shall agree on the settings of synchronisation devices to be concluded prior to operation of the Power Generating Module. This | 2. The Network Operator and the Power Generating Facility Owner shall agree on the settings of synchronisation devices to be concluded prior to operation of the Generating Unit. This agreement shall cover the following matters: voltage, | | |
| | | | | | | agreement shall cover the following matters: voltage, frequency, phase angle range, phase sequence, deviation of voltage and frequency as specified in Article 11 – (4). pursuant to Article 4(3), As per Type C | frequency, phase angle range, phase sequence, deviation of voltage and frequency as specified in Article 9—6(a) pursuant to Article 4(3). | | |
| Auto Reclosure GB – Not | Synchronous and | <u>2, 5</u> | Not specified | Not specified | Not specified | As per Type C | Single phase or three phase auto- | <u>N/S</u> | <u>N/S</u> |

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| | TABLE 2 – GB Grid Code Comparison to ENTSO-E RfG | | | | | | | | |
|---------------------------------------|--|-----|--|------------------------------------|---|---|--|--|--|
| Requirement Plant | | Key | GB Power Station Type | | ENTSO-E RfG– Generating Unit Type | | | ре | |
| • | Type | 2 | Large | Medium | Small | D | C | B | A |
| | | | > 100 MW (E&W) > 30 MW (SPT) > 10 MW | 50 – 100MW N/A (SPT / SHETL) | < 50MW < 30MW (SPT) < 10 MW (SHETL) | > 30MW or connected at 110kV or above | 30 – 10 MW_(GB) and connected below 110kV and | 1 – 10 MW_(GB) and connected below 110kV and | 8400W – 1 MW and connected below 110kV |
| | | | (SHETL) | 32.2, | (0.12.2) | and subject to Article 4(3) and | subject to Article 4(3) and Article 3 | subject to Article 4(3) and Article 3 | 20.011 |
| specified ENTSO-E Article 109 – 4(be) | Asynchronous | | | | | Article 6 (d) | reclosures on meshed lines (if applicable) to this network should be withstood by Power Generating Modules without tripping. Details of this capability shall be subject to coordination and agreements on protection schemes and settings as detailed in Article 9-(5)(b). Relevant Network Operators have the right (Pursuant to | (6) (b) | |
| | | | | | | | Article 4(3)) to request single phase autoreclosure on Generating Unit supply lines (radial connection of one or more Generating Units to the public network) and single phase or | | |
| | | | | | | | three phase auto | | |

| | TABLE 2 – GB Grid Code Comparison to ENTSO-E RfG | | | | | | | | |
|---|--|-------------------------------|------------------------------------|-----------------------------------|-----------------|-----------------------------------|-------------------------------------|-------------------------------|----------------------|
| Requirement | Plant | int Key GB Power Station Type | | ENTSO-E RfG Generating Unit Type | | | | | |
| | Type | 2 | Large Large | Medium | Small | D | C | B | A |
| | | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW (GB) | 1 – 10 MW (GB) | <u>8</u> 400W – 1 MW |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected |
| | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV |
| | | | (SHETL) | | | and subject to | subject to Article | subject to Article | |
| | | | | | | Article 4(3) and Article 6 (d) | 4(3) and Article 3 (6) (c) | 4(3) and Article 3 (6) (b) | |
| | | | | | | Article 6 (u) | meshed Network | <u>(0) (D)</u> | |
| | | | | | | | lines to be | | |
| | | | | | | | withstood by | | |
| | | | | | | | Generating Units | | |
| | | | | | | | without tripping. If | | |
| | | | | | | | the first auto- | | |
| | | | | | | | reclosure attempt | | |
| | | | | | | | is not successful, a subsequent | | |
| | | | | | | | attempt will be | | |
| | | | | | | | delayed by at least | | |
| | | | | | | | 3 seconds. | | |
| Provisions for | <u>Asynchronous</u> | <u>6</u> | | N/S | N/S | As per Type C | The relevant TSO | N/S | N/S |
| Synthetic Inertia | | | Not currently | | | | shall have the | | |
| GB Grid Code – | | | within the GB Grid | | | | right to require | | |
| <u>ENTSO-E Article</u> <u>16 – (2)</u> | | | Code but under | | | | (whilst respecting the provisions | | |
| <u>10 – (2)</u> | | | development as | | | | Article 4 (3) in co- | | |
| | | | part of the Grid Code Frequency | | | | operation with | | |
| | | | Response | | | | other TSO's for a | | |
| | | | Working Group | | | | Power Park | | |
| | | | | | | | Module which is | | |
| | | | | | | | not inherently | | |
| | | | | | | | capable of supplying | | |
| | | | | | | | additional Active | | |
| | | | | | | | Power to the | | |
| | | | | | | | Network by its | | |
| | | | | | | | inertia and which | | |
| | | | | | | | is greater than a | | |
| | | | | | | | MW size to be | | |
| | | | | | | | specified by the Relevant TSO to | | |
| | | | | | | | install a feature in | | |

| TABLE 2 – GB Grid Code Comparison to ENTSO-E RfG | | | | | | | | | |
|--|------|---------|-----------------------|------------|-----------------|-----------------------------------|-----------------------------------|--------------------|----------------------|
| Requirement Plant | | int Key | GB Power Station Type | | | ENTSO-E RfG– Generating Unit Type | | | |
| | Type | 2 | Large | Medium | Small | D | C | B | A |
| | | | > 100 MW (E&W) | 50 – 100MW | < 50MW | > 30MW or | 30 – 10 MW_(GB) | 1 – 10 MW_(GB) | <u>8</u> 400W – 1 MV |
| | | | > 30 MW (SPT) | N/A (SPT / | < 30MW (SPT) | connected at | and connected | and connected | and connected |
| | | | > 10 MW | SHETL) | < 10 MW (SHETL) | 110kV or above | below 110kV and | below 110kV and | below 110kV |
| | | | (SHETL) | | | and subject to | subject to Article | subject to Article | |
| | | | | | | Article 4(3) and | 4(3) and Article 3 | 4(3) and Article 3 | |
| | | | | | | Article 6 (d) | <u>(6) (c)</u> | <u>(6) (b)</u> | |
| | | | | | | | the control system | | |
| | | | | | | | which operates | | |
| | | | | | | | the Power Park | | |
| | | | | | | | Module so as to | | |
| | | | | | | | supply additional Active Power to | | |
| | | | | | | | the Network in | | |
| | | | | | | | order to limit the | | |
| | | | | | | | rate of change of | | |
| | | | | | | | frequency | | |
| | | | | | | | following a sudden | | |
| | | | | | | | loss of infeed. | | |
| | | | | | | | The operating | | |
| | | | | | | | principle and | | |
| | | | | | | | associated | | |
| | | | | | | | <u>performance</u> | | |
| | | 1 | | | | | parameters shall | | |
| | | | | | | | be specified by the | | |
| | | | | | | | TSO whilst | | |
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