
All Recipients of the Serviced Grid Code

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8 November 2021

Dear Sir/Madam

THE SERVICED GRID CODE – ISSUE 6 REVISION 8

Issue 6 Revision 8 of the Grid Code has been approved by the Authority for implementation on **8 November 2021**

In order to ensure your copy of the Grid Code remains up to date, you will need to replace the section affected with the revised version available on the National Grid Electricity System Operator website.

The revisions document provides an overview of the changes made to the Grid Code since the previous issue.

Yours faithfully

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THE GRID CODE – ISSUE 6 REVISION 8

INCLUSION OF REVISED SECTION

- Operating Code 2
- Operating Code 3
- Operating Code 5

SUMMARY OF CHANGES

The changes arise from the implementation of modifications proposed in the GC0151 Final Modification Report:

- **GC0151: Grid Code Compliance with Fault Ride Through Requirements**

Summary of GC0151 and Impact:

This alternative submitted by the ESO differs from the original in the process described following a suspected FRT failure. It maintains the right of the ESO to manage the system by seeking to agree immediate restrictions with users and hence in the ESO's view allows a better and more immediate management of system risk and compliance. It also allows the ESO to seek agreement to a restriction to zero output whereas the Original only allows restriction to 70%.

Impact:

High impact: on Generators, Transmission System Operators, Interconnectors;

Medium impact: on Network Operators

THE GRID CODE

ISSUE 6

REVISION 8

8 November 2021

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OPERATING CODE NO. 2

(OC2)

OPERATIONAL PLANNING AND DATA PROVISION

CONTENTS

(This contents page does not form part of the Grid Code)

<u>Paragraph No/Title</u>	<u>Page Number</u>
OC2.1 INTRODUCTION.....	2
OC2.2 OBJECTIVE	3
OC2.3 SCOPE.....	3
OC2.4 PROCEDURE	3
OC2.4.1 Co-ordination of outages	3
OC2.4.2 Data Requirements	13
OC2.4.3 Negative Reserve Active Power Margins.....	16
OC2.4.4 Frequency Sensitive Operation	17
OC2.4.6 Operating Margin Data Requirements	18
APPENDIX 1 - PERFORMANCE CHART EXAMPLES	20
APPENDIX 2 - GENERATION PLANNING PARAMETERS.....	23
APPENDIX 3 - CCGT MODULE PLANNING MATRIX	25
APPENDIX 4 - POWER PARK MODULE PLANNING MATRIX	26

OC2.1 INTRODUCTION

OC2.1.1 **Operating Code No. 2 ("OC2")** is concerned with:

- (a) the co-ordination of the release of **Power Generating Modules** (including **DC Connected Power Park Modules**), **Synchronous Generating Units** and **Power Park Modules**, **External Interconnections**, the **National Electricity Transmission System** and **Network Operators' Systems** for construction, repair and maintenance;
- (b) provision by **The Company** of the **Surplus** for the **National Electricity Transmission System**;
- (c) the provision by **Generators** of **Generation Planning Parameters** for **Gensets**, including **Synchronous Power Generating Module Planning Matrices**, **CCGT Module Planning Matrices** and **Power Park Module Planning Matrices**, to **The Company** for planning purposes only; and
- (d) the agreement for release of **Existing Gas Cooled Reactor Plant** for outages in certain circumstances.

OC2.1.2 (a) **Operational Planning** involves planning, through various timescales, the matching of generation output with forecast **National Electricity Transmission System Demand** together with a reserve of generation to provide a margin, taking into account outages of certain **Power Generating Modules** (including **DC Connected Power Park Modules**), **Generating Units**, **Power Park Modules**, **External Interconnections**, **HVDC Systems** and **DC Converters**, and of parts of the **National Electricity Transmission System** and of parts of **Network Operators' Systems** which is carried out to achieve, so far as possible, the standards of security set out in **The Company's Transmission Licence**, each **Relevant Transmission Licensee's Transmission Licence** or **Electricity Distribution Licence** as the case may be.

- (b) In general terms, there is an "envelope of opportunity" for the release of **Power Generating Modules** (including **DC Connected Power Park Modules**), **Synchronous Generating Units**, **Power Park Modules** and **External Interconnections**, and for the release of parts of the **National Electricity Transmission System** and parts of the **Network Operator's User Systems** for outages. The envelope is defined by the difference between the total generation output expected from **Large Power Stations**, **Medium Power Stations** and **Demand**, the operational planning margin and taking into account **External Interconnections**.

OC2.1.3 In this **OC2**, for the purpose of **Generator** and **Interconnector Owner** outage co-ordination, Year 0 means the current calendar year at any time, Year 1 means the next calendar year at any time, Year 2 means the calendar year after Year 1, etc. For the purpose of **Transmission** outage planning, Year 0 means the current **Financial Year** at any time, Year 1 means the next **Financial Year** at any time, Year 2 means the **Financial Year** after Year 1, etc. References to 'weeks' in **OC2** are to calendar weeks as defined in ISO 8601.

OC2.1.4 References in **OC2** to a **Generator's** and **Interconnector Owner's** "best estimate" shall be that **Generator's** or **Interconnector Owner's** best estimate acting as a reasonable and prudent **Generator** or **Interconnector Owner** in all the circumstances.

OC2.1.5 References to **The Company** planning the **National Electricity Transmission System** outage programme on the basis of the **Final Generation Outage Programme**, are to **The Company** planning against the **Final Generation Outage Programme** current at the time it so plans.

OC2.1.6 Where in **OC2**, data is required to be submitted or information is to be given on a particular weekday, that data does not need to be submitted and that information does not need to be given on that day if it is not a **Business Day** or it falls within a holiday period (the occurrence and length of which shall be determined by **The Company**, in its reasonable discretion, and notified to **Users**). Instead, that data shall be submitted and/or that information shall be given on such other **Business Day** as **The Company** shall, in its reasonable discretion, determine. However, **The Company** may determine that that data and/or information need not be submitted or given at all, in which case it shall notify each **User** as appropriate.

- OC2.1.7 In Scotland, it may be possible with the agreement of **The Company** to reduce the administrative burden for **Users** in producing planning information where either the output or demand is small.
- OC2.2 OBJECTIVE
- OC2.2.1 (a) The objective of **OC2** is to seek to enable **The Company** to harmonise outages of **Power Generating Modules** (including **DC Connected Power Park Modules**), **Generating Units**, **Power Park Modules** and **External Interconnections** in order that such outages are co-ordinated (taking account of **Embedded Medium Power Stations**) between **Generators** and **Network Operators**, and that such outages are co-ordinated taking into account **National Electricity Transmission System** outages and other **System** outages, so far as possible to minimise the number and effect of constraints on the **National Electricity Transmission System** or any other **System**.
- (b) In the case of **Network Operator' User Systems** directly connected to the **National Electricity Transmission System**, this means in particular that there will also need to be harmonisation of outages of **Embedded Power Generating Modules**, **Embedded Synchronous Generating Units** and **Embedded Power Park Modules**, and **National Electricity Transmission System** outages, with **Network Operators** in respect of their outages on those **Systems**.
- OC2.2.2 The objective of **OC2** is also to enable the provision by **The Company** of the **Surplus** for the **National Electricity Transmission System**.
- OC2.2.3 A further objective of **OC2** is to provide for the agreement for outages for **Existing Gas Cooled Reactor Plant** in certain circumstances and to enable a process to be followed in order to provide for that.
- OC2.3 SCOPE
- OC2.3.1 **OC2** applies to **The Company** and to **Users** which in **OC2** means:
- (a) **Generators**, only in respect of their **Large Power Stations** or their **Power Stations** which are directly connected to **National Electricity Transmission System** (and the term **Generator** in this **OC2** shall be construed accordingly);
- (b) **Network Operators**; and
- (c) **Non-Embedded Customers**; and
- (d) **HVDC System Owners** and **DC Converter Station** owners; and
- (e) **Interconnector Owners** in respect of their **External Interconnections**.
- OC2.3.2 **The Company** may provide to the **Relevant Transmission Licensees** any data which has been submitted to **The Company** by any **Users** in respect of **Relevant Units** pursuant to the following paragraphs of the **OC2**.
- OC2.4.1.2.1
- OC2.4.1.3.2 (a)
- OC2.4.1.3.2 (b)
- OC2.4.1.3.3
- OC2.4.2.1 (a)
- OC2.3.3 For the purpose of **OC2** only, the term **Output Usable** shall include the terms **Interconnector Export Capacity** and **Interconnector Import Capacity** where the term **Output Usable** is being applied to an **External Interconnection**.
- OC2.4 PROCEDURE
- OC2.4.1 Co-ordination of Outages
- OC2.4.1.1 Under **OC2** the interaction between **The Company** and **Users** will be as follows:

- | | | |
|-----|---|--|
| (a) | Each Generator , and each Interconnector Owner and The Company | In respect of outages of Power Generating Modules (including DC Connected Power Park Modules), Synchronous Generating Units , Power Park Modules and External Interconnection Circuits and in respect of outages of other Plant and/or Apparatus directly connected to the National Electricity Transmission System ; |
| (b) | The Company and each Generator and each Interconnector Owner | in respect of National Electricity Transmission System outages relevant to each Generator (other than in respect of Embedded Small Power Stations or Embedded Medium Power Stations) and Interconnector Owner ; |
| (c) | The Company and each Network Operator | in respect of outages of all Embedded Large Power Stations and in respect of outages of other Plant and/or Apparatus relating to such Embedded Large Power Stations ; |
| (d) | The Company and each Network Operator and each Non-Embedded Customer | in respect of National Electricity Transmission System outages relevant to the particular Network Operator or Non-Embedded Customers ; |
| (e) | Each Network Operator and each Non-Embedded Customer and The Company | in respect of User System outages relevant to The Company ; and
in respect of Network Operators only, outages of the Network Operator's User System that may impact upon an Offshore Transmission System connected to that Network Operator's User System . |

OC2.4.1.2 Data Provision of **Output Usable** of **Power Generating Modules**, **Generating Units**, **External Interconnection Circuits** and **Power Park Modules** and the Publication of **National Surplus**.

OC2.4.1.2.1 In the event that:

- a) a **Generator** referred to in OC2.3.1(a) experiences any unplanned change to the availability of a **Generating Unit** and/or **Power-Generating Module** and/or **Power Park Module** or makes a future plan which would impact the availability of a **Generating Unit** and/or **Power-Generating Module** and/or **Power Park Module** resulting in a change of level in the **Output Usable** of that **Generating Unit** and/or **Power-Generating Module** and/or **Power Park Module** below or above its previously notified availability, which is expected to last one **Settlement Period** or longer and up to three years ahead; or
- b) an **Interconnector Owner** referred to in OC2.3.1(e) experiences any unplanned change to the availability of an **External Interconnection Circuit** or makes a future plan which would impact the availability of an **External Interconnection Circuit** resulting in any change in the **Output Usable** of that **External Interconnection Circuit** below or above its previously notified availability, which is expected to last one **Settlement Period** or longer and up to three years ahead;

The **Generator** or **Interconnector Owner** shall provide **The Company** with the best estimate of the revised available **Output Usable** profile using one of **The Company's** recommended platforms.

For **Generators** subject to EU Transparency Regulations the **Generator** shall provide the data within 1 hour of the unplanned change in availability occurring, and for a planned change to the availability, the **Generator** shall provide the data within 1 hour of planning the availability change in line with EU Transparency Regulations. For **Generators** not subject to EU Transparency Regulations the **Generator** shall provide the data within 24 hours of the unplanned change in availability occurring, and for a planned change to the availability, the **Generator** shall provide the data within 24 hours of planning the availability change.

For an unplanned change in availability, the **Interconnector Owner** shall provide the data within 1 hour of the unplanned change in availability occurring, and for a planned change to the availability, the **Interconnector Owner** shall provide the data within 1 hour of planning the availability change in line with EU Transparency Regulations.

If the **Generator** referred to in OC2.3.1(a) provides information relating to multi-shaft **Generating Units** then the detail of the individual shaft availability levels, that have been summed to produce the **Output Usable** should also be defined within 24 hours.

In the case of an **External Interconnection Circuit**, the details of the individual pole-capacity levels that have been summed to produce the **Output Usable** should also be defined within 24 hours.

The Company may, as appropriate, contact each **Generator** and each **Interconnector Owner** who has supplied information to seek clarification on their **Output Usable** submissions.

OC2.4.1.2.2 At a regular time interval, at least once per day (by 1600 hours) and up to every hour:

The Company will:

(i) having taken into account the information notified to it by **Generators** and **Interconnector Owners** via the process defined in OC2.4.1.2.1 and taking into account:

- (1) **Demand** forecasts and details of proposed use of **Demand Control** received under **OC1**, and an **Operational Planning Margin** requirement set by **The Company** (the "OPMR"),
- (2) **National Electricity Transmission System** constraints and outages,
- (3) **Network Operator System** constraints and outages, known to **The Company**, and
- (4) the **Output Usable** required, in its view, to meet daily total MW requirements,

Provide each **Generator** and each **Interconnector Owner** (where required by **The Company**) in writing with any suggested amendments to the provisional **Output Usable** supplied by the **Generator** and **Interconnector Owner** which **The Company** believes necessary, and will advise **Generators** with **Large Power Stations** of the **Surpluses** for the **National Electricity Transmission System** and potential export limitations, which would occur without such amendments;

(ii) calculate and submit to **BMRA**:

1. total generating **Output Usable** from **Generating Units** assumed to be available to the **Total System** (**National Output Useable**);
2. generating **Output Usable** by fuel type from **Generating Units** assumed to be available to the **Total System** (**Output Useable** by fuel type);
3. generating **Output Usable** by individual **Generating Units** assumed to be available to the **Total System** (**Output Useable** by **Generating Unit**);
4. total **Generating Plant Demand Margin** assumed to be available to the **Total System** (**National Margin**);
5. total **Generating Surplus** assumed to be available to the **Total System** (**National Surplus**);

with daily resolution, for at least the peak **Demand** of each day for 2 day-ahead to 14 day-ahead time scope, and

with weekly resolution, for at least peak **Demand** of each week for 2 week-ahead up to 3 year-ahead time scope.

The calculation under (ii) will effectively define the envelope of opportunity for outages of **Power Generating Modules** (including **DC Connected Power Park Modules**), **Synchronous Generating Units** and **Power Park Modules** covering both **Embedded** and directly connected **Large Power Stations**.

The Company may, as appropriate, contact each **Generator** and each **Interconnector Owner** who has supplied information to seek clarification on outages and suggest amendments.

- (iii) Where a **Generator** or **Interconnector Owner** or a **Network Operator** is unhappy with the suggested amendments to its provisional outage programme (in the case of a **Generator** or **Interconnector Owner**) or such potential outages (in the case of a **Network Operator**) it may contact **The Company** to explain its concerns and **The Company** and that **Generator**, **Interconnector Owner** or **Network Operator** will then discuss the problem and seek to resolve it.
- (iv) The possible resolution of the problem may require **The Company** or a **User** to contact other **Generators**, **Interconnector Owner** or **Network Operators**, and joint meetings of all parties may, if any **User** feels it would be helpful, be convened by **The Company**. The need for further discussions, be they on the telephone or at meetings, can only be determined at the time.

Each **Generator** will provide **The Company** with updated **Output Usable** as per OC2.4.1 resulting from the above for **Generating Unit**, **Power Generating Module** and **Power Part Module** outage programme covering both **Embedded** and non-**Embedded Large Power Stations**.

The Company will then consider the updated **Output Usable** and takes this into account in the next calculation and submission to **BMRA**.

OC2.4.1.2.3 **The Company** retains the right to contact **Generators** with **Large Power Stations**, **Interconnector Owners** and **Network Operators** in reference to planned outages of their assets in timescales beyond the European Requirements (3 years) up to the 5 year ahead period to assist in the operational planning of **National Electricity Transmission System** outages.

OC2.4.1.3 Planning of National Electricity Transmission System Outages

OC2.4.1.3.1 Operational Planning Phase - Planning for Financial Years 2 to 5 inclusive ahead

The Company shall plan **National Electricity Transmission System** outages required in Years 2 to 5 inclusive required as a result of construction or refurbishment works. This contrasts with the planning of **National Electricity Transmission System** outages required in Years 0 and 1 ahead, when **The Company** also takes into account **National Electricity Transmission System** outages required as a result of maintenance.

Users should bear in mind that **The Company** will be planning the **National Electricity Transmission System** outage programme on the basis of the previous year's **Final Generation Outage Programme** and if in the event a **Generator's**, an **Interconnector Owner's** or **Network Operator's** outages differ from those contained in the **Final Generation Outage Programme**, or in the case of **Network Operators**, those known to **The Company**, in any way conflict with the **National Electricity Transmission System** outage programme, **The Company** need not alter the **National Electricity Transmission System** outage programme.

OC2.4.1.3.2 In each calendar year:

(a) By the end of week 8

Each **Network Operator** will notify **The Company** in writing of details of proposed outages in Years 2-5 ahead in its **User System** which may affect the performance of the **Total System** (which includes but is not limited to outages of **User System Apparatus** at **Grid Supply Points** and outages which constrain the output of **Power Generating Modules** (including **DC Connected Power Park Modules**) and/or **Synchronous Generating Units** and/or **Power Park Modules Embedded** within that **User System**).

Each **Network Operator** will notify **The Company** in writing of details of proposed outages in Years 2-5 ahead in its **User System** which may affect the declared values of **Maximum Export Capacity** and/or **Maximum Import Capacity** for each **Interface Point** within its **User System** together with the **Network Operator's** revised best estimate of the **Maximum Export Capacity** and/or **Maximum Import Capacity** during such outages. **Network Operators** will also notify **The Company** of any automatic and/or manual post fault actions that it intends to utilise or plans to utilise during such outages.

(b) By the end of week 13

Each **Generator** will inform **The Company** in writing of proposed outages in Years 2 - 5 ahead of **Generator** owned **Apparatus** (eg. busbar selectors) other than **Power Generating Modules** (including **DC Connected Power Park Modules**) and/or **Synchronous Generating Units**, and/or **Power Park Modules**, at each **Grid Entry Point**.

The Company will provide to each **Network Operator** and to each **Generator** and each **Interconnector Owner**, a copy of the information given to **The Company** under paragraph (a) above (other than the information given by that **Network Operator**). In relation to a **Network Operator**, the data must only be used by that **User** in planning and operating that **Network Operator's User System** and must not be used for any other purpose or passed on to, or used by, any other business of that **User** or to, or by, any person within any other such business or elsewhere.

(c) By the end of week 28

The Company will provide each **Network Operator** in writing with details of proposed outages in Years 2-5 ahead which may, in **The Company's** reasonable judgement, affect the performance of that **Network Operator's User System**.

(d) By the end of week 30

Where **The Company** or a **Network Operator** is unhappy with the proposed outages notified to it under (a), (b) or (c) above, as the case may be, equivalent provisions to those set out in OC2.4.1.2.1 (d) will apply.

(e) By the end of week 34

The Company will draw up a draft **National Electricity Transmission System** outage plan covering the period Years 2 to 5 ahead and **The Company** will notify each **Generator**, **Interconnector Owner** and **Network Operator** in writing of those aspects of the plan which may operationally affect such **Generator** (other than those aspects which may operationally affect **Embedded Small Power Stations** or **Embedded Medium Power Stations**), **Interconnector Owner** or **Network Operator**. **The Company** will also indicate where a need may exist to issue other operational instructions or notifications (including but not limited to the requirement for the arming of an **Operational Intertripping** scheme) or **Emergency Instructions** to **Users** in accordance with **BC2** to allow the security of the **National Electricity Transmission System** to be maintained within the **Licence Standards**.

OC2.4.1.3.3 Operational Planning Phase - Planning for Financial Year 1 ahead

Each calendar year, **The Company** shall update the draft **National Electricity Transmission System** outage plan prepared under OC2.4.1.3.2 above and shall in addition take into account outages required as a result of maintenance work.

In each calendar year:

(a) By the end of week 13

Generators and **Non-Embedded Customers** will inform **The Company** in writing of proposed outages for Year 1 of **Generator** owned **Apparatus** at each **Grid Entry Point** (e.g. busbar selectors) other than **Power Generating Modules** (including **DC Connected Power Park Modules**), **Synchronous Generating Units** and/or **Power Park Modules** or **Non-Embedded Customer** owned **Apparatus**, as the case may be, at each **Grid Supply Point**.

(b) By the end of week 28

The Company will provide each **Network Operator** and each **Non-Embedded Customer** in writing with details of proposed outages in Year 1 ahead which may, in **The Company's** reasonable judgement, affect the performance of its **User System** or the **Non-Embedded Customer Apparatus** at the **Grid Supply Point**.

(c) By the end of week 32

Each **Network Operator** will notify **The Company** in writing with details of proposed outages in Year 1 in its **User System** which may affect the performance of the **Total System** (which includes but is not limited to outages of **User System Apparatus** at **Grid Supply Points** and outages which constrain the output of **Power Generating Modules** (including **DC Connected Power Park Modules**), **Synchronous Generating Units** and/or **Power Park Modules Embedded** within that **User System**).

Each **Network Operator** will notify **The Company** in writing of details of proposed outages in Year 1 in its **User System** which may affect the declared values of **Maximum Export Capacity** and/or **Maximum Import Capacity** for each **Interface Point** within its **User System** together with the **Network Operator's** revised best estimate of the **Maximum Export Capacity** and/or **Maximum Import Capacity** during such outages. **Network Operators** will also notify **The Company** of any automatic and/or manual post fault actions that it intends to utilise or plans to utilise during such outages.

Each **Network Operator** will also notify **The Company** in writing of any revisions to **Interface Point Target Voltage/Power Factor** data submitted pursuant to PC.A.2.5.4.2.

(d) Between the end of week 32 and the end of week 34

The Company will draw up a revised **National Electricity Transmission System** outage plan (which for the avoidance of doubt includes **Transmission Apparatus** at the **Connection Points**).

(e) By the end of week 34

The Company will notify each **Generator**, **Interconnector Owner**, and **Network Operator**, in writing, of those aspects of the **National Electricity Transmission System** outage programme which may, in **The Company's** reasonable opinion, operationally affect that **Generator** (other than those aspects which may operationally affect **Embedded Small Power Stations** or **Embedded Medium Power Stations**), **Interconnector Owner**, or **Network Operator** including in particular proposed start dates and end dates of relevant **National Electricity Transmission System** outages.

The Company will provide to each **Network Operator** and to each **Generator** and each **Interconnector Owner** a copy of the information given to **The Company** under paragraph (c) above (other than the information given by that **Network Operator**). In relation to a **Network Operator**, the data must only be used by that **User** in planning and operating that **Network Operator's User System** and must not be used for any other purpose or passed on to, or used by, any other business of that **User** or to, or by, any person within any other such business or elsewhere.

(f) By the end of week 36

Where a **Generator**, **Interconnector Owner** or **Network Operator** is unhappy with the proposed aspects notified to it under (e) above, equivalent provisions to those set out in OC2.4.1.2.1 (d) will apply.

(g) Between the end of week 34 and 49

The Company will draw up a final **National Electricity Transmission System** outage plan covering Year 1.

(h) By the end of week 49

(i) **The Company** will complete the final **National Electricity Transmission System** outage plan for Year 1. The plan for Year 1 becomes the final plan for Year 0 when by expiry of time Year 1 becomes Year 0.

(ii) **The Company** will notify each **Generator**, each **Interconnector Owner** and each **Network Operator** in writing of those aspects of the plan which may operationally affect such **Generator** (other than those aspects which may operationally affect **Embedded Small Power Stations** or **Embedded Medium Power Stations**), **Interconnector Owner** or **Network Operator** including in particular proposed start dates and end dates of relevant **National Electricity Transmission System** outages. **The Company** will also indicate where a need may exist to issue other operational instructions or notifications (including but not limited to the requirement for the arming of an **Operational Intertripping** scheme) or **Emergency Instructions to Users** in accordance with **BC2** to allow the security of the **National Electricity Transmission System** to be maintained within the **Licence Standards**. **The Company** will also inform each relevant **Non-Embedded Customer** of the aspects of the plan which may affect it.

(iii) In addition, in relation to the final **National Electricity Transmission System** outage plan for Year 1, **The Company** will provide to each **Generator** and each **Interconnector Owner** a copy of the final **National Electricity Transmission System** outage plan for that year. OC2.4.1.3.4 contains provisions whereby updates of the final **National Electricity Transmission System** outage plan are provided. The plan and the updates will be provided in writing. It should be noted that the final **National Electricity Transmission System** outage plan for Year 1 and the updates will not give a complete understanding of how the **National Electricity Transmission System** will operate in real time, where the **National Electricity Transmission System** operation may be affected by other factors which may not be known at the time of the plan and the updates. Therefore, **Users** should place no reliance on the plan or the updates showing a set of conditions which will actually arise in real time.

(i) Information Release Or Exchange

This paragraph (i) contains alternative requirements on **The Company**, paragraph (z) being an alternative to a combination of paragraphs (x) and (y). Paragraph (z) will only apply in relation to a particular **User** if **The Company** and that **User** agree that it should apply, in which case paragraphs (x) and (y) will not apply. In the absence of any relevant agreement between **The Company** and the **User**, **The Company** will only be required to comply with paragraphs (x) and (y).

Information Release To Each Network Operator And Non-Embedded Customer

Between the end of Week 34 and 49 **The Company** will upon written request:

(x) for radial systems, provide each **Network Operator** and **Non Embedded Customer** with data to allow the calculation by the **Network Operator**, and each **Non Embedded Customer**, of symmetrical and asymmetrical fault levels; and

(y) for interconnected **Systems**, provide to each **Network Operator** an equivalent network, sufficient to allow the identification of symmetrical and asymmetrical fault levels, and power flows across interconnecting **User Systems** directly connected to the **National Electricity Transmission System**; or

System Data Exchange

(z) as part of a process to facilitate understanding of the operation of the **Total System**,

- (1) **The Company** will make available to each **Network Operator**, the **National Electricity Transmission System Study Network Data Files** covering Year 1 which are of relevance to that **User's System**;
- (2) where **The Company** and a **User** have agreed to the use of data links between them, the making available will be by way of allowing the **User** access to take a copy of the **National Electricity Transmission System Study Network Data Files** once during that period. The **User** may, having taken that copy, refer to the copy as often as it wishes. Such access will be in a manner agreed by **The Company** and may be subject to separate agreements governing the manner of access. In the absence of agreement, the copy of the **National Electricity Transmission System Study Network Data Files** will be given to the **User** on a disc, or in hard copy, as determined by **The Company**;
- (3) the data contained in the **National Electricity Transmission System Study Network Data Files** represents **The Company's** view of operating conditions although the actual conditions may be different;
- (4) **The Company** will notify each **Network Operator**, as soon as reasonably practicable after it has updated the **National Electricity Transmission System Study Network Data Files** covering Year 1 that it has done so, when this update falls before the next annual update under this OC2.4.1.3.3(i). **The Company** will then make available to each **Network Operator** who has received an earlier version (and in respect of whom the agreement still exists), the updated **National Electricity Transmission System Study Network Files** covering the balance of Years 1 and 2 which remain given the passage of time, and which are of relevance to that **User's System**. The provisions of paragraphs (2) and (3) above shall apply to the making available of these updates;
- (5) the data from the **National Electricity Transmission System Study Network Data Files** received by each **Network Operator** must only be used by that **User** in planning and operating that **Network Operator's User System** and must not be used for any other purpose or passed on to, or used by, any other business of that **User** or to, or by, any person within any other such business or elsewhere.

OC2.4.1.3.4 Operational Planning Phase - Planning In Financial Year 0 Down To The Programming Phase (And In The Case Of Load Transfer Capability, Also During The Programming Phase)

- (a) The **National Electricity Transmission System** outage plan for Year 1 issued under OC2.4.1.3.3 shall become the plan for Year 0 when by expiry of time Year 1 becomes Year 0.
- (b) Each **Generator** or **Interconnector Owner** or **Network Operator** or **Non-Embedded Customer** may at any time during Year 0, request **The Company** in writing for changes to the outages requested by them under OC2.4.1.3.3. In relation to that part of Year 0, excluding the period 1-7 weeks from the date of request, **The Company** shall determine whether the changes are possible and shall notify the **Generator**, **Interconnector Owner**, **Network Operator** or **Non-Embedded Customer** in question whether this is the case as soon as possible, and in any event within 14 days of the date of receipt by **The Company** of the written request in question.

Where **The Company** determines that any change so requested is possible and notifies the relevant **User** accordingly, **The Company** will provide to each **Network Operator**, each **Interconnector Owner**, and each **Generator** a copy of the request to which **The Company** has agreed which relates to outages on **Systems** of **Network Operators** (other than any request made by that **Network Operator**). The information must only be used by that **Network Operator** in planning and operating that **Network Operator's User System** and must not be used for any other purpose or passed on to, or used by, any other business of that **User** or to, or by, any person within any other such business or elsewhere.

- (c) During Year 0 (including the **Programming Phase**) each **Network Operator** shall at **The Company's** request, make available to **The Company**, such details of automatic and manual load transfer capability of:
- (i) 12MW or more (averaged over any half hour) for England and Wales
 - (ii) 10MW or more (averaged over any half hour) for Scotland

between Grid Supply Points.

During Year 0 (including the **Programming Phase**) each **Network Operator** shall notify **The Company** of any revisions to the information provided pursuant to OC2.4.1.3.3 (c) for **Interface Points** as soon as reasonably practicable after the **Network Operator** becomes aware of the need to make such revisions.

- (d) When necessary during Year 0, **The Company** will notify each **Generator**, each **Interconnector Owner** and **Network Operator** and each **Non-Embedded Customer**, in writing of those aspects of the **National Electricity Transmission System** outage programme in the period from the 8th week ahead to the 52nd week ahead, which may, in **The Company's** reasonable opinion, operationally affect that **Generator** (other than those aspects which may operationally affect **Embedded Small Power Stations** or **Embedded Medium Power Stations**) **Interconnector Owner** or **Network Operator** or **Non-Embedded Customer** including in particular proposed start dates and end dates of relevant **National Electricity Transmission System** outages.

The Company will also notify changes to information supplied by **The Company** pursuant to OC2.4.1.3.3(i)(x) and (y) except where in relation to a **User** information was supplied pursuant to OC2.4.1.3.3(i)(z). In that case:-

- (i) **The Company** will, by way of update of the information supplied by it pursuant to OC2.4.1.3.3(i)(z), make available at the first time in Year 0 that it updates the **National Electricity Transmission System Study Network Data Files** in respect of Year 0 (such update being an update on what was shown in respect of Year 1 which has then become Year 0) to each **Network Operator** who has received an earlier version under OC2.4.1.3.3(i)(z) (and in respect of whom the agreement still exists), the **National Electricity Transmission System Study Network Data Files** covering Year 0 which are of relevance to that **User's System**.
- (ii) **The Company** will notify each relevant **Network Operator**, as soon as reasonably practicable after it has updated the **National Electricity Transmission System Study Network Data Files** covering Year 0, that it has done so. **The Company** will then make available to each such **Network Operator**, the updated **National Electricity Transmission System Study Network Data Files** covering the balance of Year 0 which remains given the passage of time, and which are of relevance to that **User's System**.
- (iii) The provisions of OC2.4.1.3.3(i)(z)(2), (3) and (5) shall apply to the provision of data under this part of OC2.4.1.3.4(d) as if set out in full.

The Company will also indicate where a need may exist to issue other operational instructions or notifications (including but not limited to the requirement for the arming of an **Operational Intertipping** scheme) or **Emergency Instructions** to **Users** in accordance with **BC2** to allow the security of the **National Electricity Transmission System** to be maintained within the **Licence Standards**.

- (e) In addition, by the end of each month during Year 0, **The Company** will provide to each **Generator** and each **Interconnector Owner** a notice containing any revisions to the final **National Electricity Transmission System** outage plan for Year 1, provided to the **Generator** or the **Interconnector Owner** under OC2.4.1.3.3 or previously under this provision, whichever is the more recent.

OC2.4.1.3.5 Programming Phase

(a) By 1600 hours each Thursday

- (i) **The Company** shall continue to update a preliminary **National Electricity Transmission System** outage programme for the eighth week ahead, a provisional **National Electricity Transmission System** outage programme for the next week ahead and a final day ahead **National Electricity Transmission System** outage programme for the following day.
- (ii) **The Company** will notify each **Generator, Interconnector Owner** and **Network Operator** and each **Non-Embedded Customer**, in writing of those aspects of the preliminary **National Electricity Transmission System** outage programme which may operationally affect each **Generator** (other than those aspects which may operationally affect **Embedded Small Power Stations** or **Embedded Medium Power Stations**) or **Interconnector Owner** or **Network Operator** and each **Non-Embedded Customer** including in particular proposed start dates and end dates of relevant **National Electricity Transmission System** outages.

The Company will also notify changes to information supplied by **The Company** pursuant to OC2.4.1.3.3(i)(x) and (y) except where in relation to a **User** information was supplied pursuant to OC2.4.1.3.3(i)(z). In that case:

- (1) **The Company** will, by way of update of the information supplied by it pursuant to OC2.4.1.3.3(i)(z), make available the **National Electricity Transmission System Study Network Data Files** for the next week ahead and
- (2) **The Company** will notify each relevant **Network Operator**, as soon as reasonably practicable after it has updated the **National Electricity Transmission System Study Network Data Files** covering the next week ahead that it has done so, and
- (3) The provisions of OC2.4.1.3.3(i)(z)(2), (3) and (5) shall apply to the provision of data under this part of OC2.4.1.3.5(a)(ii) as if set out in full.

The Company may make available, the **National Electricity Transmission System Study Network Data Files** for the next week ahead where **The Company** and a particular **User** agree, and in such case the provisions of OC2.4.1.1.3.3(i)(x) and (y) and the provisions of OC2.4.1.3.4(d) and OC2.4.1.3.5(a) which relate to OC2.4.1.1.3.3(i)(x) and (y) shall not apply. In such case, the provisions of this OC2.4.1.3.5(a)(ii) 2 and 3 shall apply to the provision of the data under this part of OC2.4.1.3.5(a)(ii) as if set out in full.

The Company will also indicate where a need may exist to arm an **Operational Intertripping** scheme, emergency switching, emergency **Demand** management or other measures including the issuing of other operational instructions or notifications or **Emergency Instructions** to **Users** in accordance with **BC2** to allow the security of the **National Electricity Transmission System** to be maintained within the **Licence Standards**.

(b) By 1000 hours each Friday

Generators, Interconnector Owners and **Network Operators** will discuss with **The Company** and confirm in writing to **The Company**, acceptance or otherwise of the requirements detailed under OC2.4.1.3.5.

Network Operators shall confirm for the following week:

- (i) the details of any outages of its **User System** that will restrict the **Maximum Export Capacity** and/or **Maximum Import Capacity** at any **Interface Points** within its **User System** for the following week; and
- (ii) any changes to the previously declared values of the **Interface Point Target Voltage/Power Factor**.

- (c) By 1600 hours each Friday
- (i) **The Company** shall finalise the preliminary **National Electricity Transmission System** outage programme up to the seventh week ahead. **The Company** will endeavour to give as much notice as possible to a **Generator** with nuclear **Large Power Stations** which may be operationally affected by an outage which is to be included in such programme.
 - (ii) **The Company** shall finalise the provisional **National Electricity Transmission System** outage programme for the next week ahead.
 - (iii) **The Company** shall finalise the **National Electricity Transmission System** outage programme for the weekend through to the next normal working day.
 - (iv) In each case, **The Company** will indicate the factors set out in (a)(ii) above (other than those aspects which may operationally affect **Embedded Small Power Stations** or **Embedded Medium Power Stations**) to the relevant **Generators** and **Network Operators** and **Non-Embedded Customers**.
 - (v) Where a **Generator** with nuclear **Large Power Stations** which may be operationally affected by the preliminary **National Electricity Transmission System** outage programme referred to in (i) above (acting as a reasonable operator) is concerned on grounds relating to safety about the effect which an outage within such outage programme might have on one or more of its nuclear **Large Power Stations**, it may contact **The Company** to explain its concerns and discuss whether there is an alternative way of taking that outage (having regard to technical feasibility). If there is such an alternative way, but **The Company** refuses to adopt that alternative way in taking that outage, that **Generator** may involve the **Disputes Resolution Procedure** to decide on the way the outage should be taken. If there is no such alternative way, then **The Company** may take the outage despite that **Generator's** concerns.
- (d) By 1600 hours each Monday, Tuesday, Wednesday and Thursday
- (i) **The Company** shall prepare a final **National Electricity Transmission System** outage programme for the following day.
 - (ii) **The Company** shall notify each **Generator** and **Network Operator** and **Non-Embedded Customer** in writing of the factors set out in (a)(ii) above (other than those aspects which may operationally affect **Embedded Small Power Stations** or **Embedded Medium Power Stations**).

OC2.4.2 DATA REQUIREMENTS

OC2.4.2.1 When a **Statement of Readiness** under the **Bilateral Agreement** and/or **Construction Agreement** is submitted, and thereafter in calendar week 24 in each calendar year,

- (a) each **Generator** shall (subject to OC2.4.2.1(k)) in respect of each of its:-
- (i) **Gensets** (in the case of the **Generation Planning Parameters**); and
 - (ii) **CCGT Units** within each of its **CCGT Modules** at a **Large Power Station** (in the case of the **Generator Performance Chart**)
 - (iii) **Generating Units** within each of its **Synchronous Power Generating Modules** at a **Large Power Station** (in the case of the **Power-Generating Module Performance Chart** and **Synchronous Generating Unit Performance Chart**)
- submit to **The Company** in writing the **Generation Planning Parameters** and the **Generator Performance Charts** as required.
- (b) Each shall meet the requirements of CC.6.3.2 or ECC.6.3.2 (as applicable) and shall reasonably reflect the true operating characteristics of the **Genset**.

- (c) They shall be applied (unless revised under this **OC2** or (in the case of the **Generator Performance Chart** only) **BC1** in relation to **Other Relevant Data**) from the **Completion Date**, in the case of the ones submitted with the **Statement of Readiness**, and in the case of the ones submitted in calendar week 24, from the beginning of week 25 onwards.
- (d) They shall be in the format indicated in Appendix 1 for these charts and as set out in Appendix 2 for the **Generation Planning Parameters**.
- (e) Any changes to the **Generator Performance Chart** or **Generation Planning Parameters** should be notified to **The Company** promptly.
- (f) **Generators** should note that amendments to the composition of the **Power Generating Module**, **CCGT Module** or **Power Park Module** at **Large Power Stations** may only be made in accordance with the principles set out in PC.A.3.2.3 or PC.A.3.2.4 respectively. If in accordance with PC.A.3.2.3 or PC.A.3.2.4 an amendment is made, any consequential changes to the **Generation Planning Parameters** should be notified to **The Company** promptly.
- (g) **The Generator Performance Chart** must be as described below and demonstrate the limitation on reactive capability of the **System** voltage at 3% above nominal. It must also include any limitations on output due to the prime mover (both maximum and minimum), **Generating Unit** step up transformer or **User System**.
 - (i) For a **Synchronous Generating Unit** on a **Generating Unit** specific basis at the **Generating Unit** stator terminals. It must include details of the **Generating Unit** transformer parameters.
 - (ii) For a **Non-Synchronous Generating Unit** (excluding a **Power Park Unit**) on a **Generating Unit** specific basis at the **Grid Entry Point** (or **User System Entry Point** if **Embedded**).
 - (iii) For a **Power Park Module**, on a **Power Park Module** specific basis at the **Grid Entry Point** (or **User System Entry Point** if **Embedded**).
 - (iv) For a **DC Converter** on a **DC Converter** specific basis at the **Grid Entry Point** (or **User System Entry Point** if **Embedded**).
 - (v) For a **Synchronous Generating Unit** within a **Synchronous Power Generating Module**, both the **Power-Generating Module Performance Chart** and **Synchronous Generating Unit Performance Chart** should be provided.
- (h) For each **CCGT Unit**, and any other **Generating Unit** or **Power Park Module** or **Power Generating Module** whose performance varies significantly with ambient temperature, the **Generator Performance Chart** (including the **Power-Generating Module Performance Chart** and **Synchronous Generating Unit Performance Chart** in the case of **Synchronous Power Generating Modules**) shall show curves for at least two values of ambient temperature so that **The Company** can assess the variation in performance over all likely ambient temperatures by a process of linear interpolation or extrapolation. One of these curves shall be for the ambient temperature at which the **Generating Unit's** output, or **CCGT Module** or **Power-Generating Module** at a **Large Power Station** output or **Power Park Module's** output, as appropriate, equals its **Registered Capacity**.
- (i) The **Generation Planning Parameters** supplied under OC2.4.2.1 shall be used by **The Company** for operational planning purposes only and not in connection with the operation of the **Balancing Mechanism** (subject as otherwise permitted in the **BC**).

- (j) Each **Generator** shall in respect of each of its **Synchronous Power Generating Modules** or **CCGT Modules** (including those which are part of a **Synchronous Power Generating Module**) at **Large Power Stations** submit to **The Company** in writing a **CCGT Module Planning Matrix** and/or a **Synchronous Power-Generating Module Planning Matrix**. It shall be prepared on a best estimate basis relating to how it is anticipated the **Synchronous Power-Generating Module** or **CCGT Module** will be running and which shall reasonably reflect the true operating characteristics of the **Power-Generating Module** or **CCGT Module**. It will be applied (unless revised under this OC2) from the **Completion Date**, in the case of the one submitted with the **Statement of Readiness**, and in the case of the one submitted in calendar week 24, from the beginning of week 31 onwards. It must show the combination of **CCGT Units** or **Synchronous Power Generating Units** which would be running in relation to any given MW output, in the format indicated in Appendix 3.

Any changes must be notified to **The Company** promptly. **Generators** should note that amendments to the composition of the **CCGT Module** or **Synchronous Power-Generating Module** at **Large Power Stations** may only be made in accordance with the principles set out in PC.A.3.2.3. If in accordance with PC.A.3.2.3 an amendment is made, an updated **CCGT Module Planning Matrix** or **Synchronous Power-Generating Module Planning Matrix** must be immediately submitted to **The Company** in accordance with this OC2.4.2.1(b).

The **CCGT Module Planning Matrix** or **Synchronous Power-Generating Module Planning Matrix** will be used by **The Company** for operational planning purposes only and not in connection with the operation of the **Balancing Mechanism**.

- (k) Each **Generator** shall in respect of each of its **Cascade Hydro Schemes** also submit the **Generation Planning Parameters** detailed at OC2.A.2.6 to OC2.A.2.10 for each **Cascade Hydro Scheme**. Such parameters need not also be submitted for the individual **Gensets** within such **Cascade Hydro Scheme**.
- (l) Each **Generator** shall in respect of each of its **Power Park Modules** at **Large Power Stations** submit to **The Company** in writing a **Power Park Module Planning Matrix**. It shall be prepared on a best estimate basis relating to how it is anticipated the **Power Park Module** will be running and which shall reasonably reflect the operating characteristics of the **Power Park Module** and the **BM Unit** of which it forms part. It will be applied (unless revised under this OC2) from the **Completion Date**, in the case of the one submitted with the **Statement of Readiness**, and in the case of the one submitted in calendar week 24, from the beginning of week 31 onwards. It must show the number of each type of **Power Park Unit** in the **Power Park Module** typically expected to be available to generate and the **BM Unit** of which it forms part, in the format indicated in Appendix 4. The **Power Park Module Planning Matrix** shall be accompanied by a graph showing the variation in MW output with **Intermittent Power Source** (e.g. MW vs wind speed) for the **Power Park Module**. The graph shall indicate the typical value of the **Intermittent Power Source** for the **Power Park Module**.

Any changes must be notified to **The Company** promptly. **Generators** should note that amendments to the composition of the **Power Park Module** at **Large Power Stations** may only be made in accordance with the principles set out in PC.A.3.2.4. If in accordance with PC.A.3.2.4 an amendment is made, an updated **Power Park Module Planning Matrix** must be immediately submitted to **The Company** in accordance with this OC2.4.2.1(a).

The **Power Park Module Planning Matrix** will be used by **The Company** for operational planning purposes only and not in connection with the operation of the **Balancing Mechanism**.

- (m) For each **Synchronous Generating Unit** (including **Synchronous Generating Units** within a **Power Generating Module**) where the **Generator** intends to adjust the **Generating Unit** terminal voltage in response to a MVar output Instruction or a Target Voltage Level instruction in accordance with BC2.A.2.6 the **Generator Performance Chart** including the **Synchronous Generating Unit Performance Chart** shall show curves corresponding to the **Generating Unit** terminal voltage being controlled to its rated value and to its maximum value.

OC2.4.2.2 Each **Network Operator** shall by 1000 hrs on the day falling seven days before each **Operational Day** inform **The Company** in writing of any changes to the circuit details called for in PC.A.2.2.1 which it is anticipated will apply on that **Operational Day** (under **BC1** revisions can be made to this data).

OC2.4.2.3 Under **Retained EU Law** (Commission Regulation (EU) 543/2013), **Users** are required to submit certain data to the **Data Publisher** for publication. **The Company** is required to facilitate the collection, verification and processing of data from **Users** for onward transmission to the **Data Publisher**.

Each **Generator** and each **Non-Embedded Customer** connected to or using the **National Electricity Transmission System** shall provide **The Company** with such information as required by and set out in **DRC** Schedule 6 (**Users' Outage Data EU Transparency Availability Data**) in the timescales detailed therein.

OC2.4.3 NEGATIVE RESERVE ACTIVE POWER MARGINS

OC2.4.3.1 At a regular time interval, at least once each day (by 1600 hours) and up to every hour **The Company** will, taking into account the **Generation Outage Programme** and forecast of **Output Usable** supplied by each **Generator** and by each **Interconnector Owner** defined in OC2.4.1.2.1 and forecast **Demand** for the minimum **Demand** period, calculate and publish:-

- (1) the level of the **System NRAPM** each day within the period 2 to 14 days ahead (inclusive) and for each week the level of risk of **System NRAPM** within the 2-52 week ahead period; and
- (2) the level of the **Localised NRAPM** (currently for the main constraint between England and Scotland only) for each day within the period 2 to 14 days ahead (inclusive) having taken into account the appropriate limit on transfers to and from the **System Constraint Group** and for each week the level of risk of **Localised NRAPM** within the 2-52 week ahead period.

Outages Adjustments

- (a) Under the necessary circumstances **The Company** will then contact **Generators** in respect of their **Large Power Stations** and **Interconnector Owners** to discuss outages as set out in the following paragraphs of this OC2.4.3.1.
- (b) **The Company** will contact all **Generators** and **Interconnector Owners** in the case of low **System NRAPM** and will contact **Generators** in relation to relevant **Large Power Stations** and **Interconnector Owners** in the case of low **Localised NRAPM**. **The Company** will raise with each **Generator** and **Interconnector Owner** the problems it is anticipating due to the low **System NRAPM** or **Localised NRAPM** and will discuss:
 - (1) whether any change is possible to the estimate of **Genset** inflexibility; and
 - (2) whether **Genset** or **External Interconnection** outages can be taken to coincide with the periods of low **System NRAPM** or **Localised NRAPM** (as the case may be).

In relation to **Generators** with nuclear **Large Power Stations** the discussions on outages can include the issue of whether outages can be taken for re-fuelling purposes to coincide with the relevant low **System NRAPM** and/or **Localised NRAPM** periods.

- (c) If agreement is reached with a **Generator** or an **Interconnector Owner**, then such **Generator** or **Interconnector Owner** will take such outage, as agreed with **The Company**, and the **Generator** or an **Interconnector Owner** will issue updates to its **Output Usable** via the data provision process defined in OC2.4.1.2.1 and **The Company** will process the updated data which will then be included in the next published update of the **System NRAPM** and/or **Localised NRAPM**.
- (d) If on the day prior to an **Operational Day**, it is apparent from the **BM Unit Data** submitted by **Users** under **BC1** that **System NRAPM** and/or **Localised NRAPM** (as the case may be) is, in **The Company's** reasonable opinion, too low, then in accordance with the procedures and requirements set out in BC1.5.5 **The Company** may contact **Users** to discuss whether changes to **Physical Notifications** are possible, and if they are, will reflect those in the operational plans for the next following **Operational Day** or will, in accordance with BC2.9.4 instruct **Generators** to **De-Synchronise** a specified **Genset** for such period. In determining which **Genset** to so instruct, **BC2** provides that **The Company** will not (other than as referred to below) consider in such determination (and accordingly shall not instruct to **De-Synchronise**) any **Genset** within an **Existing Gas Cooled Reactor Plant**. **BC2** further provides that:-
- (i) **The Company** is permitted to instruct to **De-Synchronise** any **Gensets** within an **Existing AGR Plant** if those **Gensets** within an **Existing AGR Plant** have failed to offer to be flexible for the relevant instance at the request of **The Company** provided the request is within the **Existing AGR Plant Flexibility Limit**.
 - (ii) **The Company** will only instruct to **De-Synchronise** any **Gensets** within an **Existing Magnox Reactor Plant** or within an **Existing AGR Plant** (other than under (i) above) if the level of **System NRAPM** (taken together with **System** constraints) and/or **Localised NRAPM** is such that it is not possible to avoid **De-Synchronising** such **Generating Unit** or **Power Generating Module**, and provided the power flow across each **External Interconnection** is either at zero or results in an export of power from the **Total System**. This proviso applies in all cases in the case of **System NRAPM** and in the case of **Localised NRAPM**, only when the power flow would have a relevant effect.

OC2.4.4 FREQUENCY SENSITIVE OPERATION

By 1600 hours each Wednesday

- OC2.4.4.1 Using such information as **The Company** shall consider relevant including, if appropriate, forecast **Demand**, any estimates provided by **Generators** of **Genset** inflexibility and anticipated plant mix relating to operation in **Frequency Sensitive Mode**, **The Company** shall determine for the period 2 to 7 weeks ahead (inclusive) whether it is possible that there will be insufficient **Gensets** (other than those **Gensets** within **Existing Gas Cooled Reactor Plant** which are permitted to operate in **Limited Frequency Sensitive Mode** at all times under BC3.5.3) to operate in **Frequency Sensitive Mode** for all or any part of that period.
- OC2.4.4.2 BC3.5.3 explains that **The Company** permits **Existing Gas Cooled Reactor Plant** other than **Frequency Sensitive AGR Units** to operate in a **Limited Frequency Sensitive Mode** at all times.
- OC2.4.4.3 If **The Company** foresees that there will be an insufficiency in **Gensets** operating in a **Frequency Sensitive Mode**, it will contact **Generators** in order to seek to agree (as soon as reasonably practicable) that all or some of the **Gensets** (the MW amount being determined by **The Company** but the **Gensets** involved being determined by the **Generator**) will take outages to coincide with such period as **The Company** shall specify to enable replacement by other **Gensets** which can operate in a **Frequency Sensitive Mode**. If agreement is reached (which unlike the remainder of **OC2** will constitute a binding agreement) then such **Generator** will take such outage as agreed with **The Company**. If agreement is not reached, then the provisions of BC2.9.5 may apply.

OC2.4.5 If in **The Company 's** reasonable opinion it is necessary for both the procedure set out in OC2.4.3 (relating to **System NRAPM** and **Localised NRAPM**) and in OC2.4.4 (relating to operation in **Frequency Sensitive Mode**) to be followed in any given situation, the procedure set out in OC2.4.3 will be followed first, and then the procedure set out in OC2.4.4. For the avoidance of doubt, nothing in this paragraph shall prevent either procedure from being followed separately and independently of the other.

OC2.4.6 OPERATING MARGIN DATA REQUIREMENTS

OC2.4.6.1 Modifications to relay settings

'Relay settings' in this OC2.4.6.1 refers to the settings of **Low Frequency Relays** in respect of **Gensets** that are available for start from standby by **Low Frequency Relay** initiation with **Fast Start Capability** agreed pursuant to the **Bilateral Agreement**.

By 1600 hours each Wednesday

A change in relay settings will be sent by **The Company** no later than 1600 hours on a Wednesday to apply from 1000 hours on the Monday following. The settings allocated to particular **Large Power Stations** may be interchanged between 49.70Hz and 49.60Hz (or such other **System Frequencies** as **The Company** may have specified) provided the overall capacity at each setting and **System** requirements can, in **The Company 's** view, be met.

Between 1600 hours each Wednesday and 1200 hours each Friday

If a **Generator** wishes to discuss or interchange settings it should contact **The Company** by 1200 hours on the Friday prior to the Monday on which it would like to institute the changes to seek **The Company 's** agreement. If **The Company** agrees, **The Company** will then send confirmation of the agreed new settings.

By 1500 hours each Friday

If any alterations to relay settings have been agreed, then the updated version of the current relay settings will be sent to affected **Users** by 1500 hours on the Friday prior to the Monday on which the changes will take effect. Once accepted, each **Generator** (if that **Large Power Station** is not subject to forced outage or **Planned Outage**) will abide by the terms of its latest relay settings.

In addition, **The Company** will take account of any **Large Power Station** unavailability (as notified under OC2.4.1.2 submissions) in its total **Operating Reserve** policy.

The Company may from time to time, for confirmation purposes only, issue the latest version of the current relay settings to each affected **Generator**

OC2.4.6.2 Operational Planning Margin Requirements (OPMR)

At a regular time interval, at least once each day (by 1600 hours) and up to every hour

The Company will provide an indication of the level of **Operating Reserve** to be utilised by **The Company** in connection with the operation of the **Balancing Mechanism** covering a 2-14 day ahead period (with a daily peak demand resolution) and the 2-52 week resolution (with a weekly resolution focusing on the peak demand of the week). This level shall be purely indicative.

This **Operational Planning Margin** requirements indication will also note the possible level of **High Frequency Response** to be utilised by **The Company** in connection with the operation of the **Balancing Mechanism** in the week beginning with the **Operational Day** commencing during the subsequent Monday, which level shall be purely indicative.

OC2.4.7 In the event that:

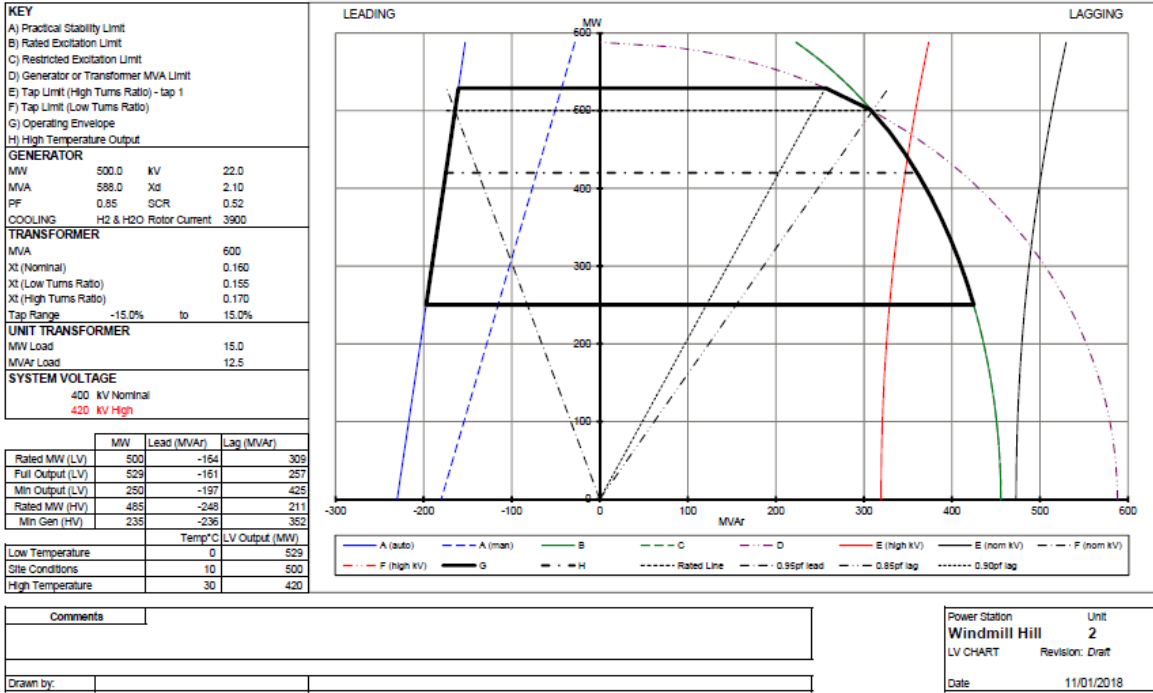
- a) a **Non-Embedded Customer** experiences the planned unavailability of its **Apparatus** resulting in the reduction of Demand of 100MW or more, or a change to the planned unavailability of its **Apparatus** resulting in a change in Demand of 100MW or more, for one Settlement Period or longer; or
- b) a **Non-Embedded Customer** experiences a change in the actual availability of its **Apparatus** resulting in a change in Demand of 100MW or greater; or
- c) a **Generator** experiences a planned unavailability of a **Generating Unit** and/or **Power-Generating Module** resulting in a change of 100MW or more in the **Output Usable** of that **Generating Unit** and/or **Power-Generating Module** below its previously notified availability, which is expected to last one **Settlement Period** or longer and up to three years ahead; or
- d) a **Generator** experiences a change of 100MW or more in the Maximum Export Limit of a **Generating Unit** which is expected to last one **Settlement Period** or longer; or
- e) a **Generator** experiences a planned unavailability resulting in a change of 100MW or more in its aggregated **Output Usable** below its previously notified availability for a **Power Station** with a **Registered Capacity** of 200MW or more and which is expected to last one **Settlement Period** or longer and up to three years ahead, save where data has been provided pursuant to OC.2.4.7(c) above; or
- f) a **Generator** experiences a change of 100MW or more in the aggregated Maximum Export Limit of a **Power Station** with a **Registered Capacity** of 200MW or more, which is expected to last one **Settlement Period** or longer, save where data has been provided pursuant to OC.2.4.7(d) above;

such **Non-Embedded Customer** or **Generator** shall provide **The Company** with the **EU Transparency Availability Data** in accordance with **DRC** Schedule 6 (Users' Outage Data) using **MODIS** and, with reference to points OC2.4.7(a) to (f), **Retained EU Law** (Commission Regulation (EU) 543/2013) articles 7.1(a), 7.1(b), 15.1(a), 15.1(b), 15.1(c) and 15.1(d).

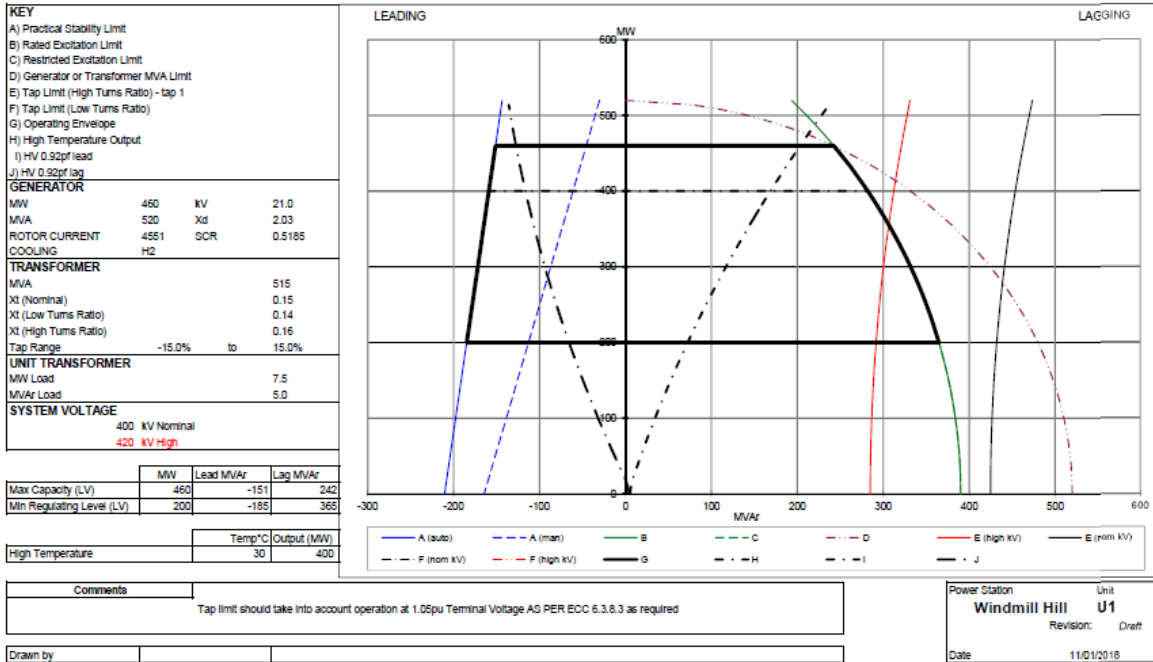
OC2.4.8 **The Company** will for each day publish the actual largest secured loss of generation (i.e. the loss of generation against which, as a requirement of the Licence Standards, the **National Electricity Transmission System** must be secured) or loss of import from **External Interconnections** for each settlement period on **The Company's** website.

APPENDIX 1 - PERFORMANCE CHART EXAMPLES

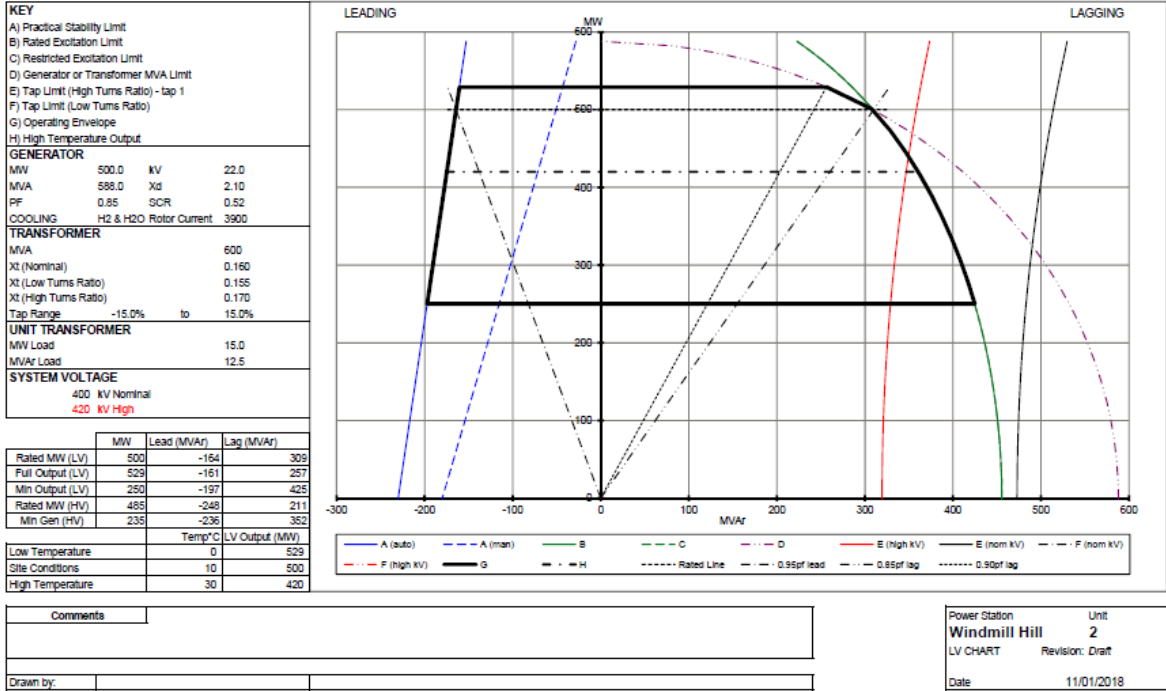
GENERATOR PERFORMANCE CHART



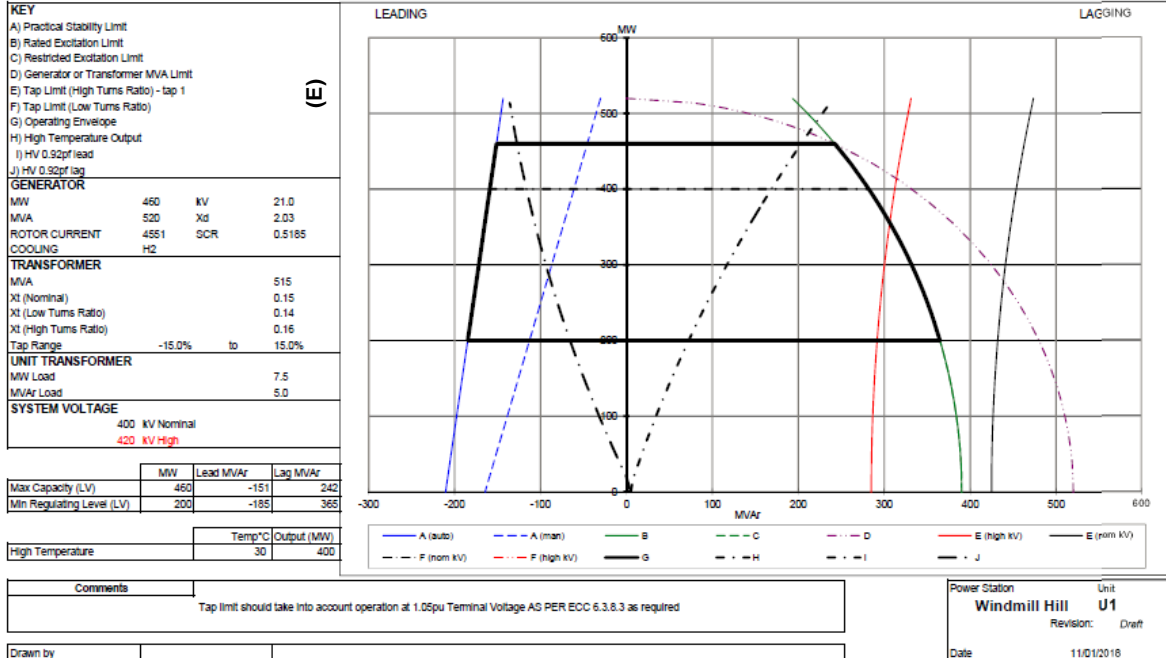
Synchronous Generating Unit Performance Chart within a Synchronous Power Generating Module



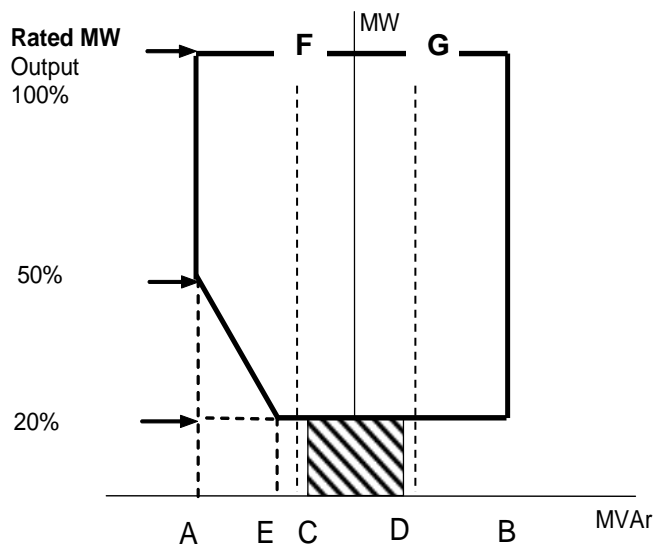
GENERATOR PERFORMANCE CHART



Synchronous Generating Unit Performance Chart within a Synchronous Power Generating Module



POWER PARK MODULE PERFORMANCE CHART AT THE CONNECTION POINT OR USER'S SYSTEM ENTRY POINT



LEADING

LAGGING

Point A is equivalent (in MVAr) to: 0.95 leading **Power Factor** at **Rated MW** output

Point B is equivalent (in MVAr) to: 0.95 lagging **Power Factor** at **Rated MW** output

Point C is equivalent (in MVAr) to: -5% of **Rated MW** output

Point D is equivalent (in MVAr) to: +5% of **Rated MW** output

Point E is equivalent (in MVAr) to: -12% of **Rated MW** output

Line F is equivalent (in MVAr) to: Leading **Power Factor Reactive Dispatch Network Restriction**

Line G is equivalent (in MVAr) to: Lagging **Power Factor Reactive Dispatch Network Restriction**

Where a **Reactive Dispatch Network Restriction** is in place which requires following of local voltage conditions, alternatively to Line F and G, please check this box.

APPENDIX 2 - GENERATION PLANNING PARAMETERS

OC2.A.2 Generation Planning Parameters

The following parameters are required in respect of each **Genset**.

OC2.A.2.1 Regime Unavailability

Where applicable the following information must be recorded for each **Genset**.

- Earliest synchronising time:
 - Monday
 - Tuesday to Friday
 - Saturday to Sunday
- Latest de-synchronising time:
 - Monday to Thursday
 - Friday
 - Saturday to Sunday

OC2.A.2.2 Synchronising Intervals

- (a) The synchronising interval between **Gensets** in a **Synchronising Group** assuming all **Gensets** have been **Shutdown** for 48 hours;
- (b) The **Synchronising Group** within the **Power Station** to which each **Genset** should be allocated.

OC2.A.2.3 De-Synchronising Interval

A fixed value **De-Synchronising** interval between **Gensets** within a **Synchronising Group**.

OC2.A.2.4 Synchronising Generation

The amount of MW produced at the moment of **Synchronising** assuming the **Genset** has been **Shutdown** for 48 hours.

OC2.A.2.5 Minimum Non-zero time (MNZT)

The minimum period on-load between **Synchronising** and **De-Synchronising** assuming the **Genset** has been **Shutdown** for 48 hours.

OC2.A.2.6 Run-Up rates

A run-up characteristic consisting of up to three stages from **Synchronising Generation** to **Output Usable** with up to two intervening break points assuming the **Genset** has been **Shutdown** for 48 hours.

OC2.A.2.7 Run-down rates

A run down characteristic consisting of up to three stages from **Output Usable** to **De-Synchronising** with breakpoints at up to two intermediate load levels.

OC2.A.2.8 Notice to Deviate from Zero (NDZ)

The period of time normally required to **Synchronise** a **Genset** following instruction from **The Company** assuming the **Genset** has been **Shutdown** for 48 hours.

OC2.A.2.9 Minimum Zero time (MZT)

The minimum interval between **De-Synchronising** and **Synchronising** a **Genset**.

OC2.A.2.10 Not used.

OC2.A.2.11 Gas Turbine Units loading parameters

- Loading rate for fast starting
- Loading rate for slow starting

APPENDIX 3 - CCGT MODULE PLANNING MATRIX

CCGT Module Planning Matrix Example Form

CCGT MODULE	CCGT GENERATING UNITS AVAILABLE								
	1st GT	2nd GT	3rd GT	4th GT	5th GT	6th GT	1st ST	2nd ST	3rd ST
	OUTPUT USABLE								
	150	150	150				100		
OUTPUT USABLE									
MW									
0MW to 150MW	/								
151MW to 250MW	/						/		
251MW to 300MW	/	/							
301MW to 400MW	/	/					/		
401MW to 450MW	/	/	/						
451MW to 550MW	/	/	/				/		

APPENDIX 4 - POWER PARK MODULE PLANNING MATRIX

Power Park Module Planning Matrix Example Form

BM Unit Name				
Power Park Module [unique identifier]				
POWER PARK UNIT AVAILABILITY	POWER PARK UNITS			
	Type A	Type B	Type C	Type D
Description (Make/Model)				
Number of units				
Power Park Module [unique identifier]				
POWER PARK UNIT AVAILABILITY	POWER PARK UNITS			
	Type A	Type B	Type C	Type D
Description (Make/Model)				
Number of units				

The **Power Park Module Planning Matrix** may have as many columns as are required to provide information on the different make and model for each type of **Power Park Unit** in a **Power Park Module** and as many rows as are required to provide information on the **Power Park Modules** within each **BM Unit**. The description is required to assist identification of the **Power Park Units** within the **Power Park Module** and correlation with data provided under the **Planning Code**.

APPENDIX 5 – SYNCHRONOUS POWER GENERATING MODULE PLANNING MATRIX

Synchronous Power Generating Module Planning Matrix Example Form

SYNCHRONOUS POWER GENERATING MODULE	SYNCHRONOUS POWER GENERATING UNITS AVAILABLE								
	1st GT	2nd GT	3rd GT	4th GT	5th GT	6th GT	1st ST	2nd ST	3rd ST
	OUTPUT USABLE								
	150	150	150				100		
OUTPUT USABLE									
MW									
0MW to 150MW	/								
151MW to 250MW	/						/		
251MW to 300MW	/	/							
301MW to 400MW	/	/					/		
401MW to 450MW	/	/	/						
451MW to 550MW	/	/	/				/		

< END OF OPERATING CODE NO. 2 >

OPERATING CODE NO. 3
(OC3)

SYSTEM INCIDENTS REPORT

CONTENTS

(This contents page does not form part of the Grid Code)

<u>Paragraph No/Title</u>	<u>Page Number</u>
OC3.1 INTRODUCTION.....	2
OC3.2 OBJECTIVE	2
OC3.3 SCOPE.....	2
OC3.4 SYSTEM INCIDENTS REPORT	2
OC3.5 REPORTING ON FAULT EVENTS	3
OC3.6 REPORTING ON LEARNING.....	3

OC3.1 INTRODUCTION

OC3.1.1 **Operating Code No.3 ("OC3")** is concerned with the monthly publication by **The Company** of an incident report and **Frequency** data for the **National Electricity Transmission System**.

OC3.2 OBJECTIVE

OC3.2.1 The objective of **OC3** is for **The Company** to produce a monthly report of incidents and frequency data. The report and data are important to industry and the **Grid Code Review Panel** as they help monitor the effectiveness of the technical requirements in the **Grid Code** and **Distribution Code**.

OC3.3 SCOPE

OC3 applies to **The Company**.

OC3.4 SYSTEM INCIDENTS REPORT

OC3.4.1 The **Company** shall prepare and submit to the **Grid Code Review Panel** monthly a report titled the **System Incidents Report**, which shall contain:

(a) a record of each and all of any of the following **Events**, defined as **Significant Events**, on the **National Electricity Transmission System**:

- (i) a loss of infeed or exfeed (import or export including generation, **Demand** and interconnection) of $\geq 250\text{MW}$;
- (ii) a **Frequency** excursion outside the limits 49.7-50.3Hz;
- (iii) a fault on the **National Electricity Transmission System** which:
 - A. could be linked to the known or reported tripping of 250MW or more as reported in (i) above; and/or
 - B. (as detailed in section CC6.1.4) is linked to a change in the **Transmission System** voltage of
 - I. 300kV or greater: $> \pm 5\%$ for $> 15\text{min}$; or
 - II. 132kV up to 300kV: $> \pm 10\%$ for $> 15\text{min}$;
- (iv) any known demand disconnected $\geq 50\text{MW}$ from the **National Electricity Transmission System** or other lesser demand if notified to **The Company**; and
- (v) any **Demand Control** action taken;

(b) a report of each such **Significant Event** including the following data in relation to each **Significant Event** as appropriate and available:

- (i) the time(s) in hh.mm.ss of the **Significant Event** and any potentially related occurrences;
- (ii) any known or reported loss of **Embedded Power Station(s)** with locations and ratings where available;
- (iii) the **Frequency** record (in table and graphical format) at ≤ 1 second intervals for 1 minute before and 1 minute after the **Significant Event**;
- (iv) the **Frequency** (to 2 decimal places) immediately before the **Significant Event**;
- (v) the **Frequency** (to 2 decimal places) immediately after the **Significant Event**;
- (vi) the maximum rate of change of **Frequency** recorded during the **Significant Event** over a specified time period of 500ms;

- (vii) where known, the MW of all individual losses or trips related to the **Significant Event**;
 - (viii) where known, the identity of the **Users** and **Network Operator** of all demand losses or trips related to the **Significant Event**;
 - (ix) the location of any reported **Transmission** fault on the network diagram and geographically;
 - (x) the extent of any voltage dip associated with the **Significant Event**;
 - (xi) an estimate of system inertia in MWs at the time of the **Significant Event** along with how it has been calculated; and
 - (xii) any other data available that is of value to gain a clearer understanding of the **Significant Event** and its potential implications; and
- (c) an outline of progress towards reporting events and associated data on the **National Electricity Transmission System** including:
- (i) three phase faults;
 - (ii) three phase to earth faults;
 - (iii) phase to phase faults;
 - (iv) phase to earth faults;
 - (v) the associated voltage dips – durations and spreads;
 - (vi) over-voltages;
 - (vii) under-voltages;
 - (viii) voltage dips of >50%; and
 - (ix) lightning strikes.

OC3.4.2 To obtain, manage, present, communicate and report the data in OC3.4.1 **The Company** shall:

- (a) present the System Incidents Report and provide, in an annex, associated data in spreadsheet format;
- (b) maintain an area of the **Website** with a list of all historic **System Incidents Reports** and information on any process required for legitimate parties to obtain the reports (if reports are not available to download); and
- (c) notify all **Electricity Distribution Licence** holders and **Network Operators** of every **Significant Event** and request information to fulfil its duties in OC3.4.1.

OC3.4.3 **The Company** shall prepare and publish the **System Incidents Report** monthly in accordance with the following timescales:

- (a) a data cut-off date of the end of each month for that reporting month;
- (b) data is collated, reviewed and processed in the subsequent two months for a reporting month;
- (c) **System Incidents Report** to be published at latest on the last working day of the second month after each reporting month (in other words the report for January would be published on the last working day of March, and so on) and submitted to the next regular **Grid Code Review Panel**. For the avoidance of doubt, if there are no incidents arising under OC3.4.1 (a)- (c) a **System Incidents Report** would, nevertheless, still be published stating that 'No System Incident occurred in month [X]'.

OC3.4.4 **The Company** shall prepare and publish monthly on the **Website**, in a spreadsheet form, **System Frequency** data at a maximum of one second intervals for the whole month (**Historic Frequency Data**) in accordance with the following timescales:

- (a) a data cut-off date of the end of each month for that reporting month;
- (b) data is collated, reviewed and processed in the subsequent ten working days after the end of the reporting month;
- (c) **Historic Frequency Data** to be published on the eleventh working day after each reporting month (in other words the report for January would be published on the eleventh working day of February, and so on).

OC3.4.5 **The Company** will use best endeavours to provide a report or reports (based on either the historic reporting methodology, or on the **Significant Incidents Reports** methodology, or a mix of the two), on events for the period from 1 November 2017 until the first **System Incidents Report** pursuant to this **Operating Code**, such a report or reports to be made available within 4 months of implementation date of the modification.

OC3.5 REPORTING ON FAULT EVENTS

OC3.5.1 **The Company** shall prepare and publish on their website a report giving date, time and location of actual three phase, three phase to earth, phase to phase and phase to earth fault events on the **National Electricity Transmission System**. Information shall be published as soon as reasonably practicable following such an event. For faults in which a fault ride through issue was found, where available, appropriate waveform information will be provided.

OC3.6 REPORTING ON LEARNING

OC3.6.1 Where the analysis of events occurring on the **National Electricity Transmission System** as set out in OC3.5.1 gives rise to learning points which **The Company** believes are relevant to the industry, **The Company** will publish a report explaining the events, the analysis and information gained as applicable. The contents of the report will be anonymised to avoid identification of **Users**, connection sites and manufacturers of **Plant** and **Apparatus** except in circumstances where OC3.6.2 applies. Where information sourced from **Users** or manufacturers is included, permission will be sought before publication.

OC3.6.2 Where **The Company** believes that it is appropriate to identify a particular **User**, connection site or **Plant** and **Apparatus**, **The Company** shall in the first instance consult the relevant **User** and/or manufacturer as applicable to seek agreement for publication.

OC3.6.3 If permission for publication is not granted by the **User** and/or manufacturer and **The Company** believes that it is appropriate to identify a particular **User**, connection site or **Plant** and **Apparatus**, **The Company** may ask the **Authority** for guidance regarding publication.

< END OF OPERATING CODE NO. 3 >

OPERATING CODE NO. 5

(OC5)

TESTING AND MONITORING

CONTENTS

(This contents page does not form part of the Grid Code)

<u>Paragraph No/Title</u>	<u>Page Number</u>
OC5.1 INTRODUCTION.....	1
OC5.2 OBJECTIVE	2
OC5.3 SCOPE.....	3
OC5.4 MONITORING	3
OC5.4.1 Parameters To Be Monitored	3
OC5.4.2 Procedure For Monitoring.....	3
OC5.5 PROCEDURE FOR TESTING	4
OC5.5.1 NGET Instruction For Testing	5
OC5.5.2 User Request For Testing	5
OC5.5.3 Conduct Of Test	6
OC5.5.4 Test And Monitoring Assessment	6
OC5.5.5 Test Failure / Re-test.....	10
OC5.5.6 Dispute Following Re-test	10
OC5.6 DISPUTE RESOLUTION	10
OC5.7.2 Procedure For A Black Start Test	12
OC5.8 PROCEDURES APPLYING TO EMBEDDED MEDIUM POWER STATION NOT SUBJECT TO A BILATERAL AGREEMENT AND EMBEDDED DC CONVERTER STATIONS NOT SUBJECT TO A BILATERAL AGREEMENT	14
APPENDIX 1 - ONSITE SIGNAL PROVISION FOR WITNESSING TESTS	17
APPENDIX 2 - COMPLIANCE TESTING OF SYNCHRONOUS PLANT	20
APPENDIX 3 - COMPLIANCE TESTING OF POWER PARK MODULES	30
APPENDIX 4 - COMPLIANCE TESTING FOR DC CONVERTERS AT A DC CONVERTER STATION	40

OC5.1 INTRODUCTION
Operating Code No. 5 ("OC5") specifies the procedures to be followed by **The Company** in carrying out:

- (a) monitoring
 - (i) of **BM Units** against their expected input or output;
 - (ii) of compliance by **Users** with the **CC** or **ECC** as applicable and in the case of response to **Frequency, BC3**; and
 - (iii) of the provision by **Users** of **Ancillary Services** which they are required or have agreed to provide; and
- (b) the following tests (which are subject to **System** conditions prevailing on the day):
 - (i) tests on **Gensets, CCGT Modules, Power Generating Modules, Power Park Modules, DC Converters, HVDC Equipment, OTSUA** (prior to the **OTSUA Transfer Time**) and **Generating Units** (excluding **Power Park Units**) to test that they have the capability to comply with the **CC** and **ECC**, and in the case of response to **Frequency, BC3** and to provide the **Ancillary Services** that they are either required or have agreed to provide;
 - (ii) tests on **BM Units**, to ensure that the **BM Units** are available in accordance with their submitted **Export and Import Limits** and **Dynamic Parameters**.

The **OC5** tests include the **Black Start Test** procedure.

OC5 also specifies in OC5.8 the procedures which apply to the monitoring and testing of **Embedded Medium Power Stations** not subject to a **Bilateral Agreement** and **Embedded DC Converter Stations** (or **Embedded HVDC Equipment**) not subject to a **Bilateral Agreement**.

In respect of a **Cascade Hydro Scheme** the provisions of **OC5** shall be applied as follows:

- (a) in respect of the **BM Unit** for the **Cascade Hydro Scheme** the parameters referred to at OC5.4.1 (a) and (c) in respect of **Commercial Ancillary Services** will be monitored and tested;
- (b) in respect of each **Genset** forming part of the **Cascade Hydro Scheme** the parameters referred to at OC5.4.1 (a), (b) and (c) will be tested and monitored. In respect of OC5.4.1 (a) the performance of the **Gensets** will be tested and monitored against their expected input or output derived from the data submitted under BC1.4.2(a)(2). Where necessary to give effect to the requirements for **Cascade Hydro Schemes** in the following provisions of **OC5**, the term **Genset** will be read and construed in the place of **BM Unit**.

In respect of **Embedded Exemptable Large Power Stations** the provisions of **OC5** shall be applied as follows:

- (a) where there is a **BM Unit** registered in the **BSC** in respect of **Generating Units** the provisions of **OC5** shall apply as written;
- (b) in all other cases, in respect of each **Power Generating Module**, and/or **Generating Unit** and **HVDC Equipment** the parameters referred to at OC5.4.1(a), (b) and (c) will be tested and monitored. In respect of OC5.4.1(a) the performance of the **Power Generating Module** and/or **Generating Unit** and **HVDC Equipment** will be tested and monitored against their expected input or output derived from the data submitted under BC1.4.2(a)(2). Where necessary to give effect to the requirements for such **Embedded Exemptable Large Power Stations** in the provisions of **OC5**, the term **Generating Unit** will be read and construed in place of **BM Unit**.

OC5.2

OBJECTIVE

The objectives of **OC5** are to establish:

- (a) that **Users** comply with the **CC** or **ECC** as applicable (including in the case of **OTSUA** prior to the **OTSUA Transfer Time**);

- (b) whether **BM Units** operate in accordance with their expected input or output derived from their **Final Physical Notification Data** and agreed **Bid-Offer Acceptances** issued under **BC2**;
- (c) whether each **BM Unit** is available as declared in accordance with its submitted **Export and Import Limits** and **Dynamic Parameters**; and
- (d) whether **Generators, DC Converter Station owners, HVDC Equipment Owners** and **Suppliers** can provide those **Ancillary Services** which they are either required or have agreed to provide.

In certain limited circumstances as specified in this **OC5**, the output of **CCGT Units** may be verified, namely the monitoring of the provision of **Ancillary Services** and the testing of **Reactive Power** and automatic **Frequency Sensitive Operation**.

OC5.3 SCOPE

OC5 applies to **The Company** and to **Users**, which in **OC5** means:

- (a) **Generators** (including those undertaking **OTSDUW**);
- (b) **Network Operators**;
- (c) **Non-Embedded Customers**;
- (d) **Suppliers**; and
- (e) **DC Converter Station owners or HVDC Equipment Owners**.

OC5.4 MONITORING

OC5.4.1 Parameters To Be monitored

The Company will monitor the performance of:

- (a) **BM Units** against their expected input or output derived from their **Final Physical Notification Data** and agreed **Bid-Offer Acceptances** issued under **BC2**;
- (b) compliance by **Users** with the **CC** or **ECC** as applicable; and
- (c) the provision by **Users** of **Ancillary Services** which they are required or have agreed to provide.

OC5.4.2 Procedure For Monitoring

OC5.4.2.1 In the event that a **BM Unit** fails persistently, in **The Company's** reasonable view, to follow, in any material respect, its expected input or output or a **User** fails persistently to comply with the **CC** or **ECC** as applicable, or fails to comply in the case of CC.6.3.15 or ECC 6.3.15 as applicable, and in the case of response to **Frequency, BC3** or to provide the **Ancillary Services** it is required, or has agreed, to provide, **The Company** shall notify the relevant **User** giving details of the failure and of the monitoring that **The Company** has carried out.

OC5.4.2.2 The relevant **User** will, as soon as possible, and in the case of a failure to comply with the requirements of CC.6.3.15 or ECC.6.3.15 as applicable, within 2 hours in respect of a notification to this effect under OC10 or a longer time period only where agreed by **The Company**, provide **The Company** with an explanation of the reasons for the failure and details of the action that it proposes to take to:

- (a) enable the **BM Unit** to meet its expected input or output or to provide the **Ancillary Services** it is required or has agreed to provide, within a reasonable period, or
- (b) in the case of a **Power Generating Module, Generating Unit** (excluding a **Power Park Unit**), **CCGT Module, Power Park Module, OTSUA** (prior to the **OTSUA Transfer Time**), **HVDC Equipment** or **DC Converter** to comply with the **CC** or **ECC** as applicable and in the case of response to **Frequency, BC3** or to provide the **Ancillary Services** it is required or has agreed to provide, within a reasonable period.

(c) in the case of a **Power Generating Module, Generating Unit** (excluding a **Power Park Unit**), **CCGT Module, Power Park Module, OTSUA** (prior to the **OTSUA Transfer Time**), **HVDC Equipment** or **DC Converter** which has tripped off or de-loaded coincident with a fault as described in CC.6.3.15 or ECC.6.3.15, resolve any non-compliance, within a reasonable period.

For the avoidance of doubt in the case of CC.6.3.15 or ECC.6.3.15 as applicable, the explanation may indicate that the **User** has complied with CC.6.3.15 or ECC.6.3.15 on the basis that:

- (i) the **User** had complied with CC.6.3.15 or ECC.6.3.15 as applicable on the basis that the **User** has provided recordings to show the voltage waveform during the fault was beyond the conditions specified in CC.6.3.15 or ECC.6.3.15 as applicable; or
- (ii) the **User's Connection Point** had been de-energised by receipt of an intertrip signal from the **National Electricity Transmission System**; or
- (iii) that other information has been shared between the **User** and **The Company** enabling agreement between them that compliance with CC.6.3.15 or ECC.6.3.15 as applicable has been confirmed.

Data relating to a fault on the **Transmission System** that **The Company** believes has led to **Users** to co-incidentally trip or de-load is to be provided by **The Company**, where available, in a file structure as agreed with the **User**. Where waveform data is available, this will be obtained from the recorder electrically closest to the **User's Connection Point**.

OC5.4.2.3 In the event of a **User** being notified under OC5.4.2.1 by **The Company** of a potential failure to comply with CC6.3.15 or ECC6.3.15 as applicable and where the **User** is required to provide an explanation as described in OC5.4.2.2(c), the **User** shall take action to restrict the output of their **Power Generating Module, Generating Unit** (excluding a **Power Park Unit**), **CCGT Module, Power Park Module, OTSUA** (prior to the **OTSUA Transfer Time**), **HVDC Equipment** or **DC Converter** to a level and for a period as agreed with **The Company** or until an explanation has been provided by the **User** and agreed between the **User** and **The Company** as set out under OC5.4.2.2(c).

OC5.4.2.4 **The Company** and the **User** will discuss any action the **User** proposes to take and will endeavour to reach agreement as to:

- (a) any short term operational measures necessary to protect other **Users**; and
- (b) the parameters which are to be submitted for the **BM Unit** and the effective time(s) and date(s) for the application of the agreed parameters. For the avoidance of doubt in the case of a failure to comply with CC.6.3.15 or ECC.6.3.15 as applicable which requires the **User** to provide an explanation as described in OC5.4.2.2(c), this may be to zero MW or another value if agreed between the **User** and **The Company**.

OC5.4.2.5 In the event that agreement cannot be reached within 10 days of notification of the failure by **The Company** to the **User**, **The Company** or the **User** shall be entitled to require a test, as set out in OC5.5 and OC5.6, to be carried out, except in respect of CC.6.3.15 or ECC.6.3.15, as applicable, where testing is impractical and OC.5.4.2.6 shall apply instead.

OC5.4.2.6 In the case of a **Power Generating Module, Generating Unit** (excluding a **Power Park Unit**), **CCGT Module, Power Park Module, OTSUA** (prior to the **OTSUA Transfer Time**), **HVDC Equipment** or **DC Converter** identifying their non-compliance with CC.6.3.15 or ECC.6.3.15 as applicable by completion of their report into this as set out in **OC10**, **The Company** will as soon as reasonably practicable, issue a **Limited Operational Notification** or amend any **Interim Operational Notification**.

OC5.5 PROCEDURE FOR TESTING

- OC5.5.1 The Company's Instruction For Testing
- OC5.5.1.1 **The Company** may at any time (although not normally more than twice in any calendar year in respect of any particular **BM Unit**) issue an instruction requiring a **User** to carry out a test, provided **The Company** has reasonable grounds of justification based upon:
- (a) a failure to agree arising from the process in CP.8.1 or ECP.8.1; or
 - (b) monitoring carried out in accordance with OC5.4.2.
- OC5.5.1.2 The test, referred to in OC5.5.1.1 and carried out at a time no sooner than 48 hours from the time that the instruction was issued, on any one or more of the **User's BM Units** should only be to demonstrate that the relevant **BM Unit**:
- (a) if active in the **Balancing Mechanism**, meets the ability to operate in accordance with its submitted **Export and Import Limits** and **Dynamic Parameters** and achieve its expected input or output which has been monitored under OC5.4; and
 - (b) meets the requirements of the paragraphs in the **CC** and **ECC** which are applicable to such **BM Units**; and
- in the case of a **BM Unit** comprising a **Generating Unit**, a **CCGT Module**, a **Power Park Module**, a **Power Generating Module**, **HVDC System** or a **DC Converter** meets,
- (c) the requirements for operation in **Frequency Sensitive Mode** and compliance with the requirements for operation in **Limited Frequency Sensitive Mode** in accordance with CC.6.3.3, ECC.6.3.3, CC.6.3.7, ECC.6.3.7, BC3.5.2, BC.3.7.1 and BC3.7.2; or
 - (d) the terms of the applicable **Bilateral Agreement** agreed with the **Generator** to have a **Fast Start Capability**; or
 - (e) the **Reactive Power** capability registered with **The Company** under **OC2** which shall meet the requirements set out in CC.6.3.2 or ECC.6.3.2 as applicable. In the case of a test on a **Generating Unit** within a **CCGT Module** the instruction need not identify the particular **CCGT Unit** within the **CCGT Module** which is to be tested, but instead may specify that a test is to be carried out on one of the **CCGT Units** within the **CCGT Module**.
- OC5.5.1.3
- (a) The instruction referred to in OC5.5.1.1 may only be issued if the relevant **User** has submitted **Export and Import Limits** which notify that the relevant **BM Unit** is available in respect of the **Operational Day** current at the time at which the instruction is issued. The relevant **User** shall then be obliged to submit **Export and Import Limits** with a magnitude greater than zero for that **BM Unit** in respect of the time and the duration that the test is instructed to be carried out, unless that **BM Unit** would not then be available by reason of forced outage or **Planned Outage** expected prior to this instruction.
 - (b) In the case of a **CCGT Module** the **Export and Import Limits** data must relate to the same **CCGT Units** which were included in respect of the **Operational Day** current at the time at which the instruction referred to in OC5.5.1.1 is issued and must include, in relation to each of the **CCGT Units** within the **CCGT Module**, details of the various data set out in BC1.A.1.3 and BC1.A.1.5, which parameters **The Company** will utilise in instructing in accordance with this **OC5** in issuing **Bid-Offer Acceptances**. The parameters shall reasonably reflect the true operating characteristics of each **CCGT Unit**.
 - (c) The test referred to in OC5.5.1.1 will be initiated by the issue of instructions, which may be accompanied by a **Bid-Offer Acceptance**, under **BC2** (in accordance with the **Export and Import Limits** and **Dynamic Parameters** which have been submitted for the day on which the test was called, or in the case of a **CCGT Unit**, in accordance with the parameters submitted under OC5.5.1.3(b)). The instructions in respect of a **CCGT Unit** within a **CCGT Module** will be in respect of the **CCGT Unit**, as provided in BC2.
- OC5.5.2 User Request For Testing
- OC5.5.2.1 Where a **GB Code User** undertakes a test to demonstrate compliance with the **Grid Code** and **Bilateral Agreement** in accordance with CP.6 or CP.7 or CP.8 (other than a failure between **The Company** and a **GB Code User** to agree in CP.8.1 where OC5.5.1.1 applies) the **GB Code User** shall request permission to test using the process laid out in OC7.5.

- OC5.5.2.2 Where an **EU Code User** undertakes a test to demonstrate compliance with the **Grid Code** and **Bilateral Agreement** in accordance with ECP.6.1, ECP.6.2, ECP.6.3 or ECP.7 or ECP.8 (other than a failure between **The Company** and a **EU Code User** to agree in ECP.8.1 where OC5.5.1.1 applies) the **EU Code User** shall request permission to test using the process laid out in OC7.5.
- OC5.5.3 Conduct Of Test
- OC5.5.3.1 The performance of the **BM Unit** will be recorded at **Transmission Control Centres** notified by **The Company** with monitoring at site when necessary, from voltage and current signals provided by the **User** for each **BM Unit** under CC.6.6.1 or ECC.6.6.1 as applicable.
- OC5.5.3.2 If monitoring at site is undertaken, the performance of the **BM Unit** will be recorded on a suitable recorder (with measurements, in the case of a **Synchronous Generating Unit** (which could be part of a **Synchronous Power Generating Module**), taken on the **Generating Unit** stator terminals / on the **LV** side of the generator transformer) or in the case of a **Non-Synchronous Generating Unit** (excluding **Power Park Units**), **Power Generating Module**, **Power Park Module** or **HVDC Equipment** or **DC Converter** at the point of connection (including where the **OTSUA** is operational prior to the **OTSUA Transfer Time**, the **Transmission Interface Point**) in the relevant **User's Control Room**, in the presence of a reasonable number of representatives appointed and authorised by **The Company**. If **The Company** or the **User** requests, monitoring at site will include measurement of the parameters set out in OC5.A.1.2 or OC5.A.1.3 or ECP.A4.2 or ECP.A.4.3 as appropriate.
- OC5.5.3.3 The **User** is responsible for carrying out the test and retains the responsibility for the safety of personnel and plant during the test.
- OC5.5.4 Test And Monitoring Assessment
- The criteria must be read in conjunction with the full text under the Grid Code reference. The **BM Unit**, **Power Generating Module**, **CCGT Module**, **Power Park Module** or **Generating Unit** (excluding **Power Park Units**), **HVDC Equipment** and **DC Converters** and **OTSUA** will pass the test the criteria below are met:

<u>Parameter to be Tested</u>		<u>Criteria against which the test results will be assessed by The Company.</u>
Voltage Quality	Harmonic Content	CC.6.1.5(a) or ECC.6.1.5(a) Measured harmonic emissions do not exceed the limits specified in the Bilateral Agreement or where no such limits are specified, the relevant planning level specified in Engineering Recommendation G5 .
	Phase Unbalance	CC.6.1.5(b) or ECC.6.1.5(b), The measured maximum Phase (Voltage) Unbalance on the National Electricity Transmission System should remain, in England and Wales, below 1% and, in Scotland, below 2% and Offshore will be defined in relevant Bilateral Agreement . CC.6.1.6 or ECC.6.1.6 In England and Wales, measured infrequent short duration peaks in Phase (Voltage) Unbalance should not exceed the maximum value stated in the Bilateral Agreement .
	Rapid Voltage Change	CC.6.1.7(a) or ECC.6.1.7(a) The measured Rapid Voltage Change at the Point of Common Coupling shall not exceed the Planning Levels specified in CC.6.1.7(a) or ECC 6.1.7.(i)
	Flicker Severity	CC.6.1.7(j) or ECC.6.1.7(j) The measured Flicker Severity at the Point of Common Coupling shall not exceed the limits specified in the table of CC.6.1.7(j) or ECC 6.1.7(j).
	Voltage Fluctuation	CC.6.1.8 or ECC.6.1.8 Offshore , measured voltage fluctuations at the Point of Common Coupling shall not exceed the limits set out in the Bilateral Agreement .
Fault Clearance	Fault Clearance Times	CC.6.2.2.2(a), CC.6.2.3.1.1(a), ECC.6.2.2.2(a), ECC.6.2.3.1.1(a), Bilateral Agreement
	Back Up Protection	CC.6.2.2.2(b), CC.6.2.3.1.1(b), ECC.6.2.2.2(a), ECC.6.2.3.1.1(a), Bilateral Agreement
	Circuit Breaker Fail Protection	CC.6.2.2.2(c), CC.6.2.3.1.1(c), ECC.6.2.2.2(c), ECC.6.2.3.1.1(c)

<u>Parameter to be Tested</u>		<u>Criteria against which the test results will be assessed by The Company.</u>
	Reactive Capability	<p>CC.6.3.2 or ECC.6.3.2 (and in the case of CC.6.3.2(e)(iii) and ECC.6.3.2.5 and ECC.6.3.2.6, the Bilateral Agreement), CC.6.3.4, Ancillary Services Agreement.</p> <p>For a test initiated under OC.5.5.1.1 the Power Generating Module, Generating Unit, HVDC Equipment, DC Converter or Power Park Module or (prior to the OTSUA Transfer Time) OTSUA will pass the test if it is within $\pm 5\%$ of the reactive capability registered with The Company under OC2. The duration of the test will be for a period of up to 60 minutes during which period the System voltage at the Grid Entry Point for the relevant Power Generating Module, Generating Unit, HVDC Equipment, DC Converter or Power Park Module or Interface Point in the case of OTSUA will be maintained by the Generator or HVDC System Owner, DC Converter Station owner at the voltage specified pursuant to BC2.8 by adjustment of Reactive Power on the remaining Power Generating Module, Generating Unit, HVDC Equipment, DC Converter or Power Park Modules or OTSUA, if necessary. Any test performed in respect of an Embedded Medium Power Station not subject to a Bilateral Agreement or, an Embedded DC Converter Station or Embedded HVDC System not subject to a Bilateral Agreement shall be as confirmed pursuant to OC5.8.3.</p> <p>Measurements of the Reactive Power output under steady state conditions should be consistent with Grid Code requirements i.e. fully available within the voltage range $\pm 5\%$ at all voltages.</p>
Governor / Frequency Control	Primary Secondary and High Frequency Response	<p>Ancillary Services Agreement, CC.6.3.7 and where applicable CC.A.3 or ECC.6.3.7 and where applicable ECC.A.3.</p> <p>For a test initiated under OC.5.5.1.1 the measured response in MW/Hz is within $\pm 5\%$ of the level of response specified in the Ancillary Services Agreement for that Genset.</p>
	Stability with Voltage	CC.6.3.4 or ECC.6.3.4
	Governor / Load / Frequency Controller System Compliance	CC.6.3.6(a), CC.6.3.7, CC.6.3.9, CC8.1, where applicable CC.A.3, BC3.5, BC3.6, BC3.7 or ECC.6.3.6, ECC.6.3.7, ECC.6.3.9, ECC8.1, where applicable ECC.A.3, BC3.5, BC3.6, BC3.7
	Output at Reduced System Frequency	CC.6.3.3 or ECC.6.3.3 - For variations in System Frequency exceeding 0.1Hz within a period of less than 10 seconds, the Active Power output is within $\pm 0.2\%$ of the requirements of CC.6.3.3 or ECC.6.3.3 when monitored at prevailing external air temperatures of up to 25°C., BC3.5.1

<u>Parameter to be Tested</u>		<u>Criteria against which the test results will be assessed by The Company.</u>
	Fast Start	Ancillary Services Agreement requirements
	Black Start	OC5.7
	Excitation/Voltage Control System	CC.6.3.6(b), CC.6.3.8, CC.A.6 or CC.A.7 as applicable, BC2.11.2, and the Bilateral Agreement or ECC.6.3.6, ECC.6.3.8, ECC.A.6 or ECC.A.7 or ECC.A.8 and the Bilateral Agreement as applicable
	Fault Ride Through and Fast Fault Current Injection	CC.6.3.15, CC.A.4.A or CC.A.4.B as applicable or ECC.6.3.15, ECC.6.3.16, ECC.A.4 as applicable
Dynamic Parameters	Export and Import Limits and Dynamic Parameters	BC2 The Export and Import Limits and Dynamic Parameters under test are within 2½% of the declared value being tested.
	Synchronisation time	BC2.5.2.3 Synchronisation takes place within ±5 minutes of the time it should have achieved Synchronisation .
	Run-up rates	BC2 Achieves the instructed output and, where applicable, the first and/or second intermediate breakpoints, each within ±3 minutes of the time it should have reached such output and breakpoints from Synchronisation (or break point, as the case may be), calculated from the run-up rates in its Dynamic Parameters .
	Run-down rates	BC2 Achieves the instructed output and, where applicable, the first and/or second intermediate breakpoints, each within ±5 minutes of the time it should have reached such output and breakpoints from Synchronisation (or break point, as the case may be), calculated from the run-up rates in its Dynamic Parameters .
	Demand Response	DRSC.11.7 Non-Embedded Customers and BM Participants who are also Demand Response Providers shall execute a demand modification test when requested as per DRSC.11.7 to ensure the requirements of the Ancillary Services agreement and Demand Response Services Code are satisfied.

- OC5.5.4.1 The duration of the **Dynamic Parameter** tests in the above table will be consistent with and sufficient to measure the relevant expected input or output derived from the **Final Physical Notification Data** and **Bid-Offer Acceptances** issued under **BC2** which are still in dispute following the procedure in OC5.4.2.
- OC5.5.4.2 Due account will be taken of any conditions on the **System** which may affect the results of the test. The relevant **User** must, if requested, demonstrate, to **The Company's** reasonable satisfaction, the reliability of the suitable recorders, disclosing calibration records to the extent appropriate.
- OC5.5.5 Test Failure / Re-test
- OC5.5.5.1 If the **BM Unit, Power Generating Module, CCGT Module, Power Park Module, OTSUA, or Generating Unit** (excluding **Power Park Units**), **HVDC Equipment** or **DC Converter Station** concerned fails to pass the test instructed by **The Company** under OC5.5.1.1, the **User** must provide **The Company** with a written report specifying in reasonable detail the reasons for any failure of the test so far as they are then known to the **User** after due and careful enquiry. This must be provided within five **Business Days** of the test.
- OC5.5.5.2 If in **The Company's** reasonable opinion, the failure to pass the test relates to compliance with the **CC** or **ECC** as applicable, then **The Company** may invoke the process detailed in CP.8.2 to CP.9, or ECP.8.2 to ECP.9
- OC5.5.5.3 If a dispute arises relating to the failure, **The Company** and the relevant **User** shall seek to resolve the dispute by discussion, and, if they fail to reach agreement, the **User** may by notice require **The Company** to carry out a re-test on 48 hours' notice which shall be carried out following the procedure set out in OC5.5.3 and OC5.5.4 and subject as provided in OC5.5.1.3, as if **The Company** had issued an instruction at the time of notice from the **User**.
- OC5.5.6 Dispute Following Re-Test
- If the **BM Unit, Power Generating Module, CCGT Module, Power Park Module, OTSUA, or Generating Unit** (excluding **Power Park Units**), **HVDC Equipment** or **DC Converter** in **The Company's** view fails to pass the re-test and a dispute arises on that re-test, either party may use the **Disputes Resolution Procedure** for a ruling in relation to the dispute, which ruling shall be binding.
- OC5.6 DISPUTE RESOLUTION
- OC5.6.1 If following the procedure set out in OC5.5 it is accepted that the **BM Unit, Power Generating Module, CCGT Module, Power Park Module, OTSUA** (prior to the **OTSUA Transfer Time**) or **Generating Unit** (excluding **Power Park Units**), **HVDC Equipment** or **DC Converter** has failed the test or re-test (as applicable), the **User** shall within 14 days, or such longer period as **The Company** may reasonably agree, following such failure, submit in writing to **The Company** for approval the date and time by which the **User** shall have brought the **BM Unit** concerned to a condition where it complies with the relevant requirement. **The Company** will not unreasonably withhold or delay its approval of the **User's** proposed date and time submitted. Should **The Company** not approve the **User's** proposed date or time (or any revised proposal), the **User** should amend such proposal having regard to any comments **The Company** may have made and re-submit it for approval.
- OC5.6.2 If a **BM Unit** fails the test, the **User** shall submit revised **Export and Import Limits** and/or **Dynamic Parameters**, or in the case of a **BM Unit** comprising a **Generating Unit, Power Generating Module, CCGT Module, HVDC Equipment, DC Converter, OTSUA** (prior to the **OTSUA Transfer Time**) or **Power Park Module**, the **User** may amend, with **The Company's** approval, the relevant registered parameters of that **Generating Unit, Power Generating Module, CCGT Module, HVDC Equipment, DC Converter, OTSUA** (prior to the **OTSUA Transfer Time**) or **Power Park Module**, as the case may be, relating to the criteria, for the period of time until the **BM Unit** can achieve the parameters previously registered, as demonstrated in a re-test.

OC5.6.3 Once the **User** has indicated to **The Company** the date and time that the **BM Unit, Power Generating Module, CCGT Module, Power Park Module, Generating Unit** (excluding **Power Park Units**) or **OTSUA** (prior to the **OTSUA Transfer Time**), **HVDC Equipment** or **DC Converter Station** can achieve the parameters previously registered or submitted, **The Company** shall either accept this information or require the **User** to demonstrate the restoration of the capability by means of a repetition of the test referred to in OC5.5.3 by an instruction requiring the **User** on 48 hours notice to carry out such a test. The provisions of this OC5.6 will apply to such further test.

OC5.7 BLACK START TESTING

OC5.7.1 General

- (a) **The Company** shall require a **Black Start Service Provider** to carry out a **Black Start Test** in order to demonstrate that a **Black Start Station** or **Black Start HVDC System** has a **Black Start Capability**.
- (i) In the case of a **Generator**, **The Company** shall require a **Generator** with a **Black Start Station** to carry out a test (either a "**Black Start Unit Test**" or a **Black Start Station Test**") in order to demonstrate that a **Black Start Station** has a **Black Start Capability**.
- (ii) In the case of an **HVDC System Owner** or **DC Converter Station Owner**, **The Company** shall require an **HVDC System Owner** or **DC Converter Station Owner** with a **Black Start HVDC System** to carry out a test (a "**Black Start HVDC Test**") on a **HVDC System** or **DC Converter**, in order to demonstrate that a **Black Start HVDC System** has a **Black Start Capability**.
- (iii) In the case of an **EU Generator**, **The Company** may also require a **Generator** with a **Black Start Station** to carry out a test (a **Quick Resynchronisation Unit Test**) in order to demonstrate that a **Black Start Station** has a **Quick Re-Synchronisation Capability**.
- (b) Where **The Company** requires a **Black Start Service Provider** to undertake testing, the following requirements shall apply:-
- (i) Where **The Company** requires a **Generator** with a **Black Start Station** to carry out a **Black Start Unit Test**, on each **Genset**, which has **Black Start Capability**, within such a **Black Start Station**, the **Generator** shall execute such a test at least once every three years. **The Company** shall not require the **Black Start Test Unit** to be carried out on more than one **Genset** at that **Black Start Station** at the same time, and would not, in the absence of exceptional circumstances, expect any of the other **Gensets** at the **Black Start Station** to be directly affected by the **Black Start Unit Test**.
- (ii) **The Company** may occasionally require the **Generator** to carry out a **Black Start Station Test** at any time (but will not require a **Black Start Station Test** to be carried out more than once in every three calendar years in respect of any particular **Genset** unless it can justify on reasonable grounds the necessity for further tests or unless the further test is a re-test). If successful, this **Black Start Station Test** shall count as a successful **Black Start Unit Test** for the **Genset** used in the test.
- (iii) **The Company** may require the **HVDC System Owner** or **DC Converter Station Owner** to carry out a **Black Start HVDC Test** at any time (but will not require such a test to be carried out more than once in every three calendar years unless it can justify on reasonable grounds the necessity for further tests or unless the further test is a re-test).
- (iv) **The Company** may occasionally require the **EU Generator** to carry out a **Quick Re-Synchronisation Test** at any time, but will generally only be required where the **EU Generator** has made a change to its **Plant** and **Apparatus** which has an impact on its **Houseload Operation** or after two unsuccessful tripping **Events** in the operational environment.

The above tests will be deemed a success where starting from **Shutdown** is achieved within a time frame specified by **The Company** and which may be agreed in the **Black Start Contract**.

- c) **The Company** may require a **Generator** to carry out a **Black Start Unit Test** at any time (but will not require a **Black Start Unit Test** to be carried out more than once in each calendar year in respect of any particular **Genset** unless it can justify on reasonable grounds the necessity for further tests or unless the further test is a re-test).
- (d) When **The Company** wishes a **Black Start Service Provider** to carry out a **Black Start Test**, it shall notify the relevant **Black Start Service Provider** at least 7 days prior to the time of the **Black Start Test** with details of the proposed **Black Start Test**.

OC5.7.2 Procedure for a Black Start Test

The following procedure will, so far as practicable, be carried out in the following sequence for **Black Start Tests**:

OC5.7.2.1 Black Start Unit Tests

- (a) The relevant **Generating Unit** shall be **Synchronised** and **Loaded**;
 - (b) All the **Auxiliary Gas Turbines** and/or **Auxiliary Diesel Engines** in the **Black Start Station** in which that **Generating Unit** is situated, shall be **Shutdown**.
 - (c) The **Generating Unit** shall be **De-Loaded** and **De-Synchronised** and all alternating current electrical supplies to its **Auxiliaries** shall be disconnected.
 - (d) The **Auxiliary Gas Turbine(s)** or **Auxiliary Diesel Engine(s)** to the relevant **Generating Unit** shall be started, and shall re-energise the **Unit Board** of the relevant **Generating Unit**.
 - (e) The **Auxiliaries** of the relevant **Generating Unit** shall be fed by the **Auxiliary Gas Turbine(s)** or **Auxiliary Diesel Engine(s)**, via the **Unit Board**, to enable the relevant **Generating Unit** to return to **Synchronous Speed**.
 - (f) The relevant **Generating Unit** shall be **Synchronised** to the **System** but not **Loaded**, unless the appropriate instruction has been given by **The Company** under **BC2** which would also be in accordance with the requirements of the **Black Start Contract**.
- (g) In respect of **EU Generators**, the above tests defined in OC5.7.2.1(a) – (e) shall be in accordance with the requirements of ECC.6.3.5.3.

OC5.7.2.2 Black Start Station Test

- (a) All **Generating Units** at the **Black Start Station**, other than the **Generating Unit** on which the **Black Start Test** is to be carried out, and all the **Auxiliary Gas Turbines** and/or **Auxiliary Diesel Engines** at the **Black Start Station**, shall be **Shutdown**.
- (b) The relevant **Generating Unit** shall be **Synchronised** and **Loaded**.
- (c) The relevant **Generating Unit** shall be **De-Loaded** and **De-Synchronised**.
- (d) All external alternating current electrical supplies to the **Unit Board** of the relevant **Generating Unit**, and to the **Station Board** of the relevant **Black Start Station**, shall be disconnected.
- (e) An **Auxiliary Gas Turbine** or **Auxiliary Diesel Engine** at the **Black Start Station** shall be started, and shall re-energise either directly, or via the **Station Board**, the **Unit Board** of the relevant **Generating Unit**.
- (f) The provisions of OC5.7.2.1 (e) and (f) shall thereafter be followed.
- (g) In respect of **EU Generators**, the above tests defined in OC5.7.2.2(a) – (e) shall be in accordance with the requirements of ECC.6.3.5.3.

OC5.7.2.3 Procedure for a Black Start HVDC Test

- a) The **HVDC System** or **DC Converter Station** shall demonstrate its technical capability to energise the busbar of the de-energised AC substation to which it is connected, within the **GB Synchronous Area** within a timeframe specified by **The Company**. In the case of **HVDC Systems** this shall be in accordance with the requirements of ECC.6.3.5.4. As part of this test, all **Auxiliaries** are required to be derived from within the **HVDC System** or **DC Converter Station**.
- b) The test shall be carried out while the **HVDC System** or **DC Converter Station** starts from **Shutdown**;
- c) The test shall be deemed passed, provided that the following conditions are cumulatively fulfilled:
 - i) The **HVDC System Owner** has demonstrated its **HVDC System** or **DC Converter Station** is able to energise the busbar of the isolated AC-substation to which it is connected within the **GB Synchronous Area**
 - ii) The **HVDC System** or **DC Converter Station** can achieve a stable operating point at an agreed capacity as agreed with **The Company**. The relevant **HVDC System** or **DC Converter Station** can be connected to the **System** but not **Loaded**, unless appropriate instructions are given by **The Company** under **BC2** which would also be in accordance with the requirements of the **Black Start Contract**.
 - iii) In respect of **HVDC Systems** and **Remote End HVDC Converter Stations**, the above tests defined in OC5.7.2.3(a) – (c) shall be in accordance with the requirements of, ECC.6.1.2, ECC.6.1.4, ECC.6.2.2.9.4 and ECC.6.3.5.4.
 - iv) In respect of **DC Converter Stations**, the above tests defined in OC5.7.2.3(a) – (c) shall be in accordance with the requirements of, CC.6.1.2, CC.6.1.3 and CC.6.1.4.

OC5.7.2.4 All **Black Start Tests** shall be carried out at the time specified by **The Company** in the notice given under OC5.7.1 and shall be undertaken in the presence of a reasonable number of representatives appointed and authorised by **The Company**, who shall be given access to all information relevant to the **Black Start Test**.

OC5.7.2.5 Failure of a Black Start Test

A **Black Start Station** or **Black Start HVDC System** shall fail a **Black Start Test** if the **Black Start Test** shows that it does not have a **Black Start Capability** (ie. if the relevant **Generating Unit** or **HVDC System** or **DC Converter** fails to be **Synchronised** to the **System** within two hours of the **Auxiliary Gas Turbine(s)** or **Auxiliary Diesel Engine(s)** being required to start unless this is part of a **Local Joint Restoration Plan** where the times will be adjusted accordingly).

OC5.7.2.6 If a **Black Start Station** or **Black Start HVDC System** fails to pass a **Black Start Test** the **Black Start Service Provider** must provide **The Company** with a written report specifying in reasonable detail the reasons for any failure of the test so far as they are then known to the **Black Start Service Provider** after due and careful enquiry. This must be provided within five **Business Days** of the test. If a dispute arises relating to the failure, **The Company** and the relevant **Black Start Service Provider** shall seek to resolve the dispute by discussion, and if they fail to reach agreement, the **Black Start Service Provider** may require **The Company** to carry out a further **Black Start Test** on 48 hours notice which shall be carried out following the procedure set out in OC5.7.2.1 or OC5.7.2.2 or OC5.7.2.3 as the case may be, as if **The Company** had issued an instruction at the time of notice from the **Black Start Service Provider**.

OC5.7.2.7 If the **Black Start Station** or **Black Start HVDC System** concerned fails to pass the re-test and a dispute arises on that re-test, either party may use the **Disputes Resolution Procedure** for a ruling in relation to the dispute, which ruling shall be binding.

OC5.7.2.8 If following the procedure in OC5.7.2.6 and OC5.7.2.7 it is accepted that the **Black Start Station** or **Black Start HVDC System** has failed the **Black Start Test** (or a re-test carried out under OC5.7.2.5), within 14 days, or such longer period as **The Company** may reasonably agree, following such failure, the relevant **Black Start Service Provider** shall submit to **The Company** in writing for approval, the date and time by which that **Black Start Service Provider** shall have brought that **Black Start Station** or **Black Start HVDC System** to a condition where it has a **Black Start Capability** and would pass the **Black Start Test**, and **The Company** will not unreasonably withhold or delay its approval of the **Black Start Service Provider's** proposed date and time submitted. Should **The Company** not approve the **Black Start Service Provider's** proposed date and time (or any revised proposal) the **Black Start Service Provider** shall revise such proposal having regard to any comments **The Company** may have made and resubmit it for approval.

OC5.7.2.9 Once the **Black Start Service Provider** has indicated to **The Company** that the **Power Station** or **HVDC System** or **DC Converter Station** has a **Black Start Capability**, **The Company** shall either accept this information or require the **Black Start Service Provider** to demonstrate that the relevant **Black Start Station** or **Black Start HVDC System** has its **Black Start Capability** restored, by means of a repetition of the **Black Start Test** referred to in OC5.7.1(d) following the same procedure as for the initial **Black Start Test**. The provisions of this OC5.7.2 will apply to such test.

OC5.7.3 Quick Re-synchronisation UnitTest

(a) The relevant **Generating Unit** shall be **Synchronised** and **Loaded**;

(b) All the **Auxiliary Gas Turbines** and/or **Auxiliary Diesel Engines** in the **Black Start Station** in which that **Generating Unit** is situated, shall be **Shutdown**.

(c) The **Generating Unit** shall tripped to house load.

(d) The relevant **Generating Unit** shall be **Synchronised** to the **System** but not **Loaded**, unless the appropriate instruction has been given by **The Company** under **BC2** which would also be in accordance with the requirements of the **Black Start Contract**.

In respect of **EU Generators**, the above tests defined in OC5.7.2.3(a) – (e) shall be in accordance with the requirements of ECC.6.3.5.6.

OC5.8 PROCEDURES APPLYING TO EMBEDDED MEDIUM POWER STATIONS NOT SUBJECT TO A BILATERAL AGREEMENT AND EMBEDDED DC CONVERTER STATIONS NOT SUBJECT TO A BILATERAL AGREEMENT

OC5.8.1 Compliance Statement

Each **Network Operator** shall ensure that each **Embedded Person** provides to the **Network Operator** upon **The Company's** request:

(a) written confirmation that each such **Power Generating Module**, **Generating Unit**, **Power Park Module**, **HVDC Equipment**, or **DC Converter** complies with the requirements of the **CC** and **ECC**; and

(b) evidence, where requested, reasonably satisfactory to **The Company**, of such compliance. Such a request shall not normally be made by **The Company** more than twice in any calendar year in respect of any **Generator's Power Generating Module**, **Generating Unit** or **Power Park Module** or **HVDC System Owner's HVDC System**, or **DC Converter** owner's **DC Converter**.

The **Network Operator** shall provide the evidence or written confirmation required under OC5.8.1 (a) and (b) forthwith upon receipt to **The Company**.

OC5.8.2 Network Operator's Obligations To Facilitate Tests

If:

- (a) the **Network Operator** fails to procure the confirmation referred to at OC5.8.1(a); or
- (b) the evidence of compliance is not to **The Company's** reasonable satisfaction,

then, **The Company** shall be entitled to require the **Network Operator** to procure access upon terms reasonably satisfactory to **The Company** to enable **The Company** to witness the **Embedded Person** carrying out the tests referred to in OC5.8.3 in respect of the relevant **Embedded Medium Power Station** or **Embedded DC Converter Station** or **Embedded HVDC System**.

OC5.8.3

Testing Of Embedded Medium Power Stations Not Subject To A Bilateral Agreement Or Embedded DC Converter Stations Not Subject To A Bilateral Agreement or Embedded HVDC Equipment Not Subject To A Bilateral Agreement

The Company may, in accordance with the provisions of OC5.8.2, at any time (although not normally more than twice in any calendar year in respect of any particular **Embedded Medium Power Station** not subject to a **Bilateral Agreement** or **Embedded DC Converter Station** or **Embedded HVDC Equipment** not subject to a **Bilateral Agreement**) issue an instruction requiring the **Network Operator** within whose **System** the relevant **Medium Power Station** not subject to a **Bilateral Agreement** or **DC Converter Station** or **HVDC Equipment** not subject to a **Bilateral Agreement** is **Embedded**, to require the **Embedded Person** to carry out a test.

Such test shall be carried out at a time no sooner than 48 hours from the time that the instruction was issued, on any one or more of the **Generating Units, Power Generating Modules, Power Park Modules** or **DC Converters** or **HVDC Equipment** comprising part of the relevant **Embedded Medium Power Station** or **Embedded DC Converter Station** or **HVDC System** and should only be to demonstrate that:

- (a) the relevant **Generating Unit, Power Generating Module, Power Park Module** or **DC Converter** or **HVDC Equipment** meets the requirements of the paragraphs in the **CC** or **ECC** which are applicable to such **Generating Units, Power Generating Modules, Power Park Module** or **DC Converter** or **HVDC Equipment**;
- (b) the **Reactive Power** capability registered with **The Company** under **OC2** meets the requirements set out in CC.6.3.2 or ECC.6.3.2 as applicable.

The instruction may only be issued where, following consultation with the relevant **Network Operator**, **The Company** has:

- (c) confirmed to the relevant **Network Operator** the manner in which the test will be conducted, which shall be consistent with the principles established in OC5.5.3; and
- (d) received confirmation from the relevant **Network Operator** that the relevant **Generating Unit, Power Generating Module, Power Park Module** or **DC Converter** or **HVDC Equipment** would not then be unavailable by reason of forced outage or **Planned Outage** expected prior to the instruction.

The relevant **Network Operator** is responsible for ensuring the performance of any test so required by **The Company** and the **Network Operator** shall ensure that the **Embedded Person** retains the responsibility for ensuring the safety of personnel and plant during the test.

OC5.8.4

Test Failures/Re-Tests And Disputes

The relevant **Network Operator** shall:

- (a) ensure that provisions equivalent to OC5.5.5, OC5.5.6 and OC5.6 apply to **Embedded Medium Power Stations** not the subject of a **Bilateral Agreement**, **Embedded DC Converter Stations** not the subject of a **Bilateral Agreement** or **Embedded HVDC Equipment** not the subject of a **Bilateral Agreement** within its **System** in respect of test failures, re-tests and disputes as to test failures and re-tests;

- (b) ensure that the provisions equivalent to OC5.5.5, OC5.5.6 and OC5.6 referred to in OC5.8.4(a) are effective so that **The Company** may require, if it so wishes, the provision to it of any reports or other information equivalent to those or that to which **The Company** would be entitled in relation to test failures, re-tests and disputes as to test failures and re-tests under the provisions of OC5.5.5, OC5.5.6 and OC5.6; and
- (c) the provisions equivalent to OC5.5.5, OC5.5.6 and OC5.6 referred to in OC5.8.4(a) are effective to permit **The Company** to conduct itself and take decisions in such a manner in relation to test failures, re-tests and disputes as to test failures and re-tests in respect of **Embedded Medium Power Stations** not the subject of a **Bilateral Agreement**, **Embedded DC Converter Stations** not the subject of a **Bilateral Agreement** or **Embedded HVDC Equipment** not the subject of a **Bilateral Agreement** as it is able to conduct itself and take decisions in relation to test failures, re-tests and disputes as to test failures and re-tests under OC5.5.5, OC5.5.6 and OC5.6.

APPENDIX 1 - ONSITE SIGNAL PROVISION FOR WITNESSING TESTS

OC5.A.1.1 During tests witnessed on-site by **The Company**, the following signals shall be provided to **The Company** by the **GB Generator**, **GB Generator** undertaking **OTSDUW** or **DC Converter Station** owner in accordance with CC.6.6.2:

OC5.A.1.2 Synchronous Generating Units

- (a) All Tests
 - MW - **Active Power** at **Generating Unit** terminals
- (b) Reactive & Excitation System
 - MVA_r - **Reactive Power** at **Generating Unit** terminals
 - V_t - **Generating Unit** terminal voltage
 - E_{fd} - **Generating Unit** field voltage and/or main exciter field voltage
 - I_{fd} – **Generating Unit** field current (where possible)
 - **Power System Stabiliser** output, where applicable.
 - Noise – Injected noise signal (where applicable and possible)
- (c) Governor System & **Frequency** Response
 - F_{sys} - **System Frequency**
 - F_{inj} - Injected Speed Reference
 - Logic - Stop / Start Logic Signal

For Gas Turbines:

- GT Fuel Demand
- GT Fuel Valve Position
- GT Inlet Guide Vane Position
- GT Exhaust Gas Temperature

For Steam Turbines at ≥ 1 Hz:

- Pressure before Turbine Governor Valves
- Turbine Governor Valve Positions
- Governor Oil Pressure*
- Boiler Pressure Set Point *
- Superheater Outlet Pressure *
- Pressure after Turbine Governor Valves*
- Boiler Firing Demand*

*Where applicable (typically not in **CCGT Module**)

For Hydro Plant:

- Speed Governor Demand Signal
- Actuator Output Signal
- Guide Vane / Needle Valve Position

(d) Compliance with CC.6.3.3

- Fsys - **System Frequency**
- Finj - Injected Speed Reference
- Appropriate control system parameters as agreed with **The Company** (See OC5.A.2.9)

OC5.A.1.3 Power Park Modules, OTSUA and DC Converters

Each **Power Park Module** and **DC Converter** at a **Grid Entry Point** or **User System Entry Point**

(a) Real Time on site.

- Total **Active Power** (MW)
- Total **Reactive Power** (MVA_r)
- Line-line Voltage (kV)
- **System Frequency** (Hz)

(b) Real Time on site or Downloadable

- Injected frequency signal (Hz) or test logic signal (Boolean) when appropriate
- Injected voltage signal (per unit voltage) or test logic signal (Boolean) when appropriate
- In the case of an **Onshore Power Park Module** the **Onshore Power Park Module** site voltage (MV) (kV)
- **Power System Stabiliser** output, where appropriate
- In the case of a **Power Park Module** or **DC Converter** where the **Reactive Power** is provided from more than one **Reactive Power** source, the individual **Reactive Power** contributions from each source, as agreed with **The Company**.
- In the case of **DC Converters** appropriate control system parameters as agreed with **The Company** (See OC5.A.4)
- In the case of an **Offshore Power Park Module** the total **Active Power** (MW) and the total **Reactive Power** (MVA_r) at the **Offshore Grid Entry Point**

(c) Real Time on site or Downloadable

- Available power for **Power Park Module** (MW)
- Power source speed for **Power Park Module** (e.g. wind speed) (m/s) when appropriate
- Power source direction for **Power Park Module** (degrees) when appropriate

See OC5.A.1.3.1

OC5.A.1.3.1 **The Company** accept that the signals specified in OC5.A.1.3(c) may have lower effective sample rates than those required in CC.6.6.2 although any signals supplied for connection to **The Company's** recording equipment which do not meet at least the sample rates detailed in CC.6.6.2 should have the actual sample rates indicated to **The Company** before testing commences.

OC5.A.1.3.2 For all **The Company** witnessed testing either;

- (i) the **Generator** or **DC Converter Station** owner shall provide to **The Company** all signals outlined in OC5.A.1.3 direct from the **Power Park Module** control system without any attenuation, delay or filtering which would result in the inability to fully demonstrate the objectives of the test, or identify any potential safety or plant instability issues, and with a signal update rate corresponding to CC.6.6.2.1; or

- (ii) in the case of **Onshore Power Park Modules**, the **Generator** or **DC Converter Station** owner shall provide signals OC5.A.1.3(a) direct from one or more transducer(s) connected to current and voltage transformers for monitoring in real time on site; or,
- (iii) In the case of **Offshore Power Park Modules** and **OTSUA** signals OC5.A.1.3(a) will be provided at the **Interface Point** by the **Offshore Transmission Licensee** pursuant to the **STC** or by the **Generator** when **OTSDUW Arrangements** apply.

OC5.A.1.3.3 Options OC5.A.1.3.2 (ii) and (iii) will only be available on condition that;

- (a) all signals outlined in OC5.A.1.3 are recorded and made available to **The Company** by the **Generator** or **DC Converter Station** owner from the **Power Park Module** or **OTSUA** or **DC Converter** control systems as a download once the testing has been completed; and
- (b) the full test results are provided by the **Generator** or **DC Converter Station** owner within 2 working days of the test date to **The Company** unless **The Company** agrees otherwise; and
- (c) all data is provided with a sample rate in accordance with CC.6.6.2.2 or ECC.6.6.3.3 unless **The Company** agrees otherwise; and
- (d) in **The Company's** reasonable opinion the solution does not unreasonably add a significant delay between tests or impede the volume of testing which can take place on the day.

OC5.A.1.3.4 In the case of where transducers connected to current and voltage transformers are installed (OC5.A.1.3.3 (ii) and (iii)), the transducers shall meet the following specification

- (a) The transducer(s) shall be permanently installed to easily allow safe testing at any point in the future, and to avoid a requirement for recalibration of the current transformers and voltage transformers.
- (b) The transducer(s) should be directly connected to the metering quality current transformers and voltage transformers or similar.
- (c) The transducers shall either have a response time no greater than 50ms to reach 90% of output, or no greater than 300ms to reach 99.5%.

APPENDIX 2 - COMPLIANCE TESTING OF SYNCHRONOUS PLANT

OC5.A.2.1 Scope

OC5.A.2.1.1 This Appendix sets out the tests contained therein to demonstrate compliance with the relevant clauses of the **Connection Conditions** of the Grid Code and apply only to **GB Generators**. This Appendix shall be read in conjunction with the **CP** with regard to the submission of the reports to **The Company**. The testing requirements applicable to **EU Generators** are specified in ECP.A.5.

OC5.A.2.1.2 The tests specified in this Appendix will normally be sufficient to demonstrate compliance however **The Company** may:

- (i) agree an alternative set of tests provided **The Company** deem the alternative set of tests sufficient to demonstrate compliance with the **Grid Code** and **Bilateral Agreement**; and/or
- (ii) require additional or alternative tests if information supplied to **The Company** during the compliance process suggests that the tests in this Appendix will not fully demonstrate compliance with the relevant section of the **Grid Code** or **Bilateral Agreement**.
- (iii) Agree a reduced set of tests for subsequent **Generating Units** following successful completion of the first **Generating Unit** tests in the case of a **Power Station** comprised of two or more **Generating Units** which **The Company** reasonably considers to be identical.

If:

- (a) the tests performed pursuant to OC5.A.2.1.2(iii) in respect of subsequent **Generating Units** do not replicate the full tests for the first **Generating Unit**, or
- (b) any of the tests performed pursuant to OC5.A.2.1.2(iii) do not fully demonstrate compliance with the relevant aspects of the **Grid Code**, **Ancillary Services Agreement** and / or **Bilateral Agreement**,

then notwithstanding the provisions above, the full testing requirements set out in this Appendix will be applied.

OC5.A.2.1.3 The **Generator** is responsible for carrying out the tests set out in and in accordance with this Appendix and the **Generator** retains the responsibility for the safety of personnel and plant during the test. **The Company** will witness all of the tests outlined or agreed in relation to this Appendix unless **The Company** decides and notifies the **Generator** otherwise. Reactive Capability tests may be witnessed by **The Company** remotely from the **The Company** control centre. During **The Company** witnessed tests, the **Generator** should ensure suitable representatives from the **Generator** and manufacturer (if appropriate) are available on site for the entire testing period. In all cases the **Generator** shall provide suitable monitoring equipment to record all relevant test signals as outlined below in OC5.A.3.1.5.

OC5.A.2.1.4 The **Generator** shall submit a schedule of tests to **The Company** in accordance with CP.4.3.1

OC5.A.2.1.5 Prior to the testing of a **Generating Unit**, the **Generator** shall complete the **Integral Equipment Test** procedure in accordance with OC.7.5

OC5.A.2.1.6 Full **Generating Unit** testing as required by CP.7.2 is to be completed as defined in OC5.A.2.2 through to OC5.A.2.9

OC5.A.2.2 Excitation System Open Circuit Step Response Tests

OC5.A.2.2.1 The open circuit step response of the **Excitation System** will be tested by applying a voltage step change from 90% to 100% of the nominal **Generating Unit** terminal voltage, with the **Generating Unit** on open circuit and at rated speed.

- OC5.A.2.2.2 The test shall be carried out prior to synchronisation in accordance with CP.6.4. This is not witnessed by **The Company** unless specifically requested by **The Company**. Where **The Company** is not witnessing the tests, the **Generator** shall supply the recordings of the following signals to **The Company** in an electronic spreadsheet format:
- Vt - **Generating Unit** terminal voltage
 - Efd - **Generating Unit** field voltage or main exciter field voltage
 - I_{fd}- **Generating Unit** field current (where possible)
 - Step injection signal
- OC5.A.2.2.3 Results shall be legible, identifiable by labelling, and shall have appropriate scaling.
- OC5.A.2.3 Open & Short Circuit Saturation Characteristics
- OC5.A.2.3.1 The test shall normally be carried out prior to synchronisation in accordance with CP.6.4. Manufacturer factory test results may be used where appropriate or manufacturers factory type test results may be used if agreed by **The Company**.
- OC5.A.2.3.2 This is not witnessed by **The Company**. Graphical and tabular representations of the results in an electronic spreadsheet format showing per unit open circuit terminal voltage and short circuit current versus per unit field current shall be submitted to **The Company**.
- OC5.A.2.3.3 Results shall be legible, identifiable by labelling, and shall have appropriate scaling.
- OC5.A.2.4 Excitation System On-Load Tests
- OC5.A.2.4.1 The time domain performance of the **Excitation System** shall be tested by application of voltage step changes corresponding to 1% and 2% of the nominal terminal voltage.
- OC5.A.2.4.2 Where a **Power System Stabiliser** is present:
- (i) The **PSS** must only be commissioned in accordance with BC2.11.2. When a **PSS** is switched on for the first time as part of on-load commissioning or if parameters have been adjusted, the **Generator** should consider reducing the **PSS** output gain by at least 50% and should consider reducing the limits on the **PSS** output by at least a factor of 5 to prevent unexpected PSS action affecting the stability of the **Generating Unit** or the **National Electricity Transmission System**.
 - (ii) The time domain performance of the **Excitation System** shall be tested by application of voltage step changes corresponding to 1% and 2% of the nominal terminal voltage, repeating with and without the **PSS** in service.
 - (iii) The frequency domain tuning of the **PSS** shall also be demonstrated by injecting a 0.2Hz-3Hz band limited random noise signal into the **Automatic Voltage Regulator** reference with the **Generating Unit** operating at points specified by **The Company** (up to rated MVA output).
 - (iv) The **PSS** gain margin shall be tested by increasing the **PSS** gain gradually to threefold and observing the **Generating Unit** steady state **Active Power** output.
 - (v) The interaction of the **PSS** with changes in **Active Power** shall be tested by application of a +0.5Hz frequency injection to the governor while the **Generating Unit** is selected to **Frequency Sensitive Mode**.
 - (vi) If the **Generating Unit** is of the pump storage type, then the step tests shall be carried out, with and without the **PSS**, in the pumping mode in addition to the generating mode.
 - (vii) Where the **Bilateral Agreement** requires that the **PSS** is in service at a specified loading level, additional testing witnessed by **The Company** will be required during the commissioning process before the **Generating Unit** or **CCGT Module** may exceed this output level.
 - (viii) Where the **Excitation System** includes a **PSS**, the **Generator** shall provide a suitable noise source to facilitate noise injection testing.

OC5.A.2.4.3 The following typical procedure is provided to assist **Generators** in drawing up their own site specific procedures for the **The Company** witnessed **PSS Tests**.

Test	Injection	Notes
	Synchronous Generator running rated MW, unity pf, PSS Switched Off	
1	<ul style="list-style-type: none"> • Record steady state for 10 seconds • Inject +1% step to AVR Voltage Reference and hold for at least 10 seconds until stabilised • Remove step returning AVR Voltage Reference to nominal and hold for at least 10 seconds 	
2	<ul style="list-style-type: none"> • Record steady state for 10 seconds • Inject +2% step to AVR Voltage Reference and hold for at least 10 seconds until stabilised • Remove step returning AVR Voltage Reference to nominal and hold for at least 10 seconds 	
3	<ul style="list-style-type: none"> • Inject band limited (0.2-3Hz) random noise signal into voltage reference and measure frequency spectrum of Real Power. • Remove noise injection. 	
	Switch On Power System Stabiliser	
4	<ul style="list-style-type: none"> • Record steady state for 10 seconds • Inject +1% step to AVR Voltage Reference and hold for at least 10 seconds until stabilised • Remove step returning AVR Voltage Reference to nominal and hold for at least 10 seconds 	
5	<ul style="list-style-type: none"> • Record steady state for 10 seconds • Inject +2% step to AVR Voltage Reference and hold for at least 10 seconds until stabilised • Remove step returning AVR Voltage Reference to nominal and hold for at least 10 seconds 	
6	<ul style="list-style-type: none"> • Increase PSS gain at 30 second intervals. i.e. x1 – x1.5 – x2 – x2.5 – x3 • Return PSS gain to initial setting 	
7	<ul style="list-style-type: none"> • Inject band limited (0.2-3Hz) random noise signal into voltage reference and measure frequency spectrum of Real Power. • Remove noise injection. 	

8	<ul style="list-style-type: none"> • Select the governor to Frequency Sensitive Mode (FSM) • Inject +0.5 Hz step into governor. • Hold until generator MW output is stabilised • Remove step 	
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OC5.A.2.5 Under-excitation Limiter Performance Test

- OC5.A.2.5.1 Initially the performance of the **Under-excitation Limiter** should be checked by moving the limit line close to the operating point of the **Generating Unit** when operating close to unity power factor. The operating point of the **Generating Unit** is then stepped into the limit by applying a 2% decrease in **Automatic Voltage Regulator** reference voltage.
- OC5.A.2.5.2 The final performance of the **Under-excitation Limiter** shall be demonstrated by testing its response to a step change corresponding to a 2% decrease in **Automatic Voltage Regulator** reference voltage when the **Generating Unit** is operating just off the limit line, at the designed setting as indicated on the **Performance Chart** submitted to **The Company** under OC2.
- OC5.A.2.5.3 Where possible, the **Under-excitation Limiter** should also be tested by operating the tap-changer when the **Generating Unit** is operating just off the limit line, as set up.
- OC5.A.2.5.4 The **Under-excitation Limiter** will normally be tested at low **Active Power** output and at maximum **Active Power** output (**Registered Capacity**).
- OC5.A.2.5.5 The following typical procedure is provided to assist **Generators** in drawing up their own site specific procedures for the **The Company** witnessed **Under-excitation Limiter** Tests.

Test	Injection	Notes
	Synchronous generator running rated MW at unity Power Factor . Under-excitation limit temporarily moved close to the operating point of the generator.	
1	<ul style="list-style-type: none"> • PSS on. • Inject -2% voltage step into AVR voltage reference and hold at least for 10 seconds until stabilised • Remove step returning AVR Voltage Reference to nominal and hold for at least 10 seconds 	
	Under-excitation limit moved to normal position. Synchronous generator running at rated MW and at leading MVARs close to Under-excitation limit.	
2	<ul style="list-style-type: none"> • PSS on. • Inject -2% voltage step into AVR voltage reference and hold at least for 10 seconds until stabilised • Remove step returning AVR Voltage Reference to nominal and hold for at least 10 seconds 	

OC5.A.2.6 Over-excitation Limiter Performance Test

Description & Purpose of Test

- OC5.A.2.6.1 The performance of the **Over-excitation Limiter**, where it exists, shall be demonstrated by testing its response to a step increase in the **Automatic Voltage Regulator** reference voltage that results in operation of the **Over-excitation Limiter**. Prior to application of the step the **Generating Unit** shall be generating **Rated Active Power** and operating within its continuous **Reactive Power** capability. The size of the step will be determined by the minimum value necessary to operate the **Over-excitation Limiter** and will be agreed by **The Company** and the **Generator**. The resulting operation beyond the **Over-excitation Limit** shall be controlled by the **Over-excitation Limiter** without the operation of any protection that could trip the **Generating Unit**. The step shall be removed immediately on completion of the test.
- OC5.A.2.6.2 If the **Over-excitation Limiter** has multiple levels to account for heating effects, an explanation of this functionality will be necessary and if appropriate, a description of how this can be tested.
- OC5.A.2.6.3 The following typical procedure is provided to assist **Generators** in drawing up their own site specific procedures for the **The Company** witnessed **Under-excitation Limiter** Tests.

Test	Injection	Notes
	Synchronous Generator running Rated MW and maximum lagging MVar.	
	Over-excitation Limit temporarily set close to this operating point. PSS on.	
1	<ul style="list-style-type: none"> • Inject positive voltage step into AVR voltage reference and hold • Wait till Over-excitation Limiter operates after sufficient time delay to bring back the excitation back to the limit. • Remove step returning AVR Voltage Reference to nominal. 	
	Over-excitation Limit restored to its normal operating value. PSS on.	

OC5.A.2.7 Reactive Capability

- OC5.A.2.7.1 The leading and lagging **Reactive Power** capability on each **Generating Unit** will normally be demonstrated by operation of the **Generating Unit** at 0.85 power factor lagging for 1 hour and 0.95 power factor leading for 1 hour.
- OC5.A.2.7.2 In the case of an **Embedded Generating Unit** where distribution network considerations restrict the **Generating Unit Reactive Power** output then the maximum leading and lagging capability will be demonstrated without breaching the host network operators limits.
- OC5.A.2.7.3 The test procedure, time and date will be agreed with **The Company** and will be to the instruction of **The Company** control centre and shall be monitored and recorded at both the **The Company** control centre and by the **Generator**.
- OC5.A.2.7.4 Where the **Generator** is recording the voltage and **Reactive Power** at the **Generating Unit** terminals, the results shall be supplied in an electronic spreadsheet format.
- OC5.A.2.7.5 The ability of the **Generating Unit** to comply with the operational requirements specified in BC2.A.2.6 and CC.6.1.7 will normally be demonstrated by changing the tap position and, where agreed in the **Bilateral Agreement**, the **Generating Unit** terminal voltage.

OC5.A.2.8 Governor and Load Controller Response Performance

- OC5.A.2.8.1 The governor and load controller response performance will be tested by injecting simulated frequency deviations into the governor and load controller systems. Such simulated frequency deviation signals must be injected simultaneously at both speed governor and load controller references. For **CCGT modules**, simultaneous injection into all gas turbines, steam turbine governors and module controllers is required.
- OC5.A.2.8.2 Prior to witnessing the governor tests set out in OC5.A.2.8.6, **The Company** requires the **Generator** to conduct the preliminary tests detailed in OC5.A.2.8.4 and send the results to **The Company** for assessment unless agreed otherwise by **The Company**. The results should be supplied in an electronic spreadsheet format. These tests shall be completed at least two weeks prior to the witnessed governor response tests.
- OC5.A.2.8.3 Where a **CCGT Module** or **Generating Unit** is capable of operating on alternative fuels, tests will be required to demonstrate performance when operating on each fuel. **The Company** may agree a reduction from the tests listed in OC5.A.2.8.6 for demonstrating performance on the alternative fuel. This includes the case where a main fuel is supplemented by bio-fuel.

Preliminary Governor Frequency Response Testing

- OC5.A.2.8.4 Prior to conducting the full set of tests as per OC5.A.2.8.6, **Generators** are required to conduct a preliminary set of tests below to confirm the frequency injection method is correct and the plant control performance is within expectation. The test numbers refer to Figure 1 below. With the plant running at 80% of full load, the following frequency injections shall be applied.

Test No (Figure 1)	Frequency Injection	Notes
8	<ul style="list-style-type: none"> • Inject - 0.5Hz frequency fall over 10 sec • Hold until conditions stabilise • Remove the injected signal 	
14	<ul style="list-style-type: none"> • Inject +0.5Hz frequency rise over 10 sec • Hold until conditions stabilise • Remove the injected signal 	
13	<ul style="list-style-type: none"> • Inject -0.5Hz frequency fall over 10 sec • Hold for a further 20 sec • At 30 sec from the start of the test, Inject a +0.3Hz frequency rise over 30 sec. • Hold until conditions stabilise • Remove the injected signal 	

- OC5.A.2.8.5 The recorded results (e.g. Finj, MW and control signals) should be sampled at a minimum rate of 1 Hz to allow **The Company** to assess the plant performance from the initial transients (seconds) to the final steady state conditions (5-15 minutes depending on the plant design). This is not witnessed by **The Company**. The **Generator** shall supply the recordings including data to **The Company** in an electronic spreadsheet format. Results shall be legible, identifiable by labelling, and shall have appropriate scaling.

Full Frequency Response Testing Schedule Witnessed by The Company

OC5.A.2.8.6 The tests are to be conducted at a number of different Module Load Points (MLP). The load points are conducted as shown below unless agreed otherwise by **The Company**.

Module Load Point 6 (Maximum Export Limit)	100% MEL
Module Load Point 5	95% MEL
Module Load Point 4 (Mid point of Operating Range)	80% MEL
Module Load Point 3	70% MEL
Module Load Point 2 (Minimum Generation)	MG
Module Load Point 1 (Design Minimum Operating Level)	DMOL

OC5.A.2.8.7 The tests are divided into the following two types;

- (i) **Frequency** response volume tests as per OC5.A.2.8. Figure 1. These tests consist of **Frequency** profile and ramp tests.
- (ii) **System** islanding and step response tests as shown by OC5.A.2.8. Figure 2.

OC5.A.2.8.8 There should be sufficient time allowed between tests for control systems to reach steady state. Where the diagram states 'HOLD' the current injection should be maintained until the **Active Power** (MW) output of the **Generating Unit** or **CCGT Module** has stabilised. The frequency response capability test (see Figure 1) injection signal shall be returned to zero at the same rate at which it was applied. **The Company** may require repeat tests should the tests give unexpected results.

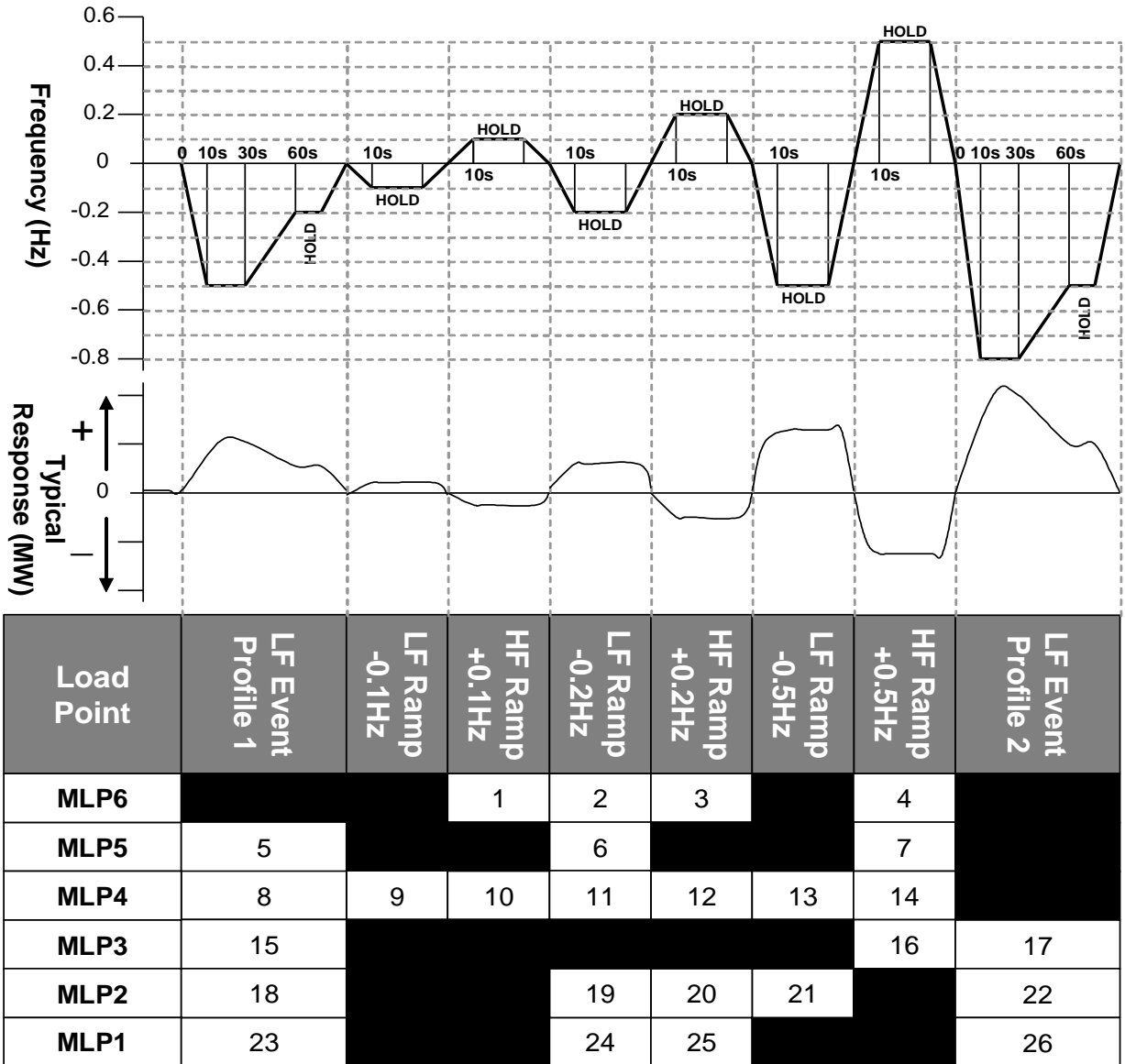


Figure 1: Frequency Response Capability Tests

Figure 2: System islanding and step response tests

* This will generally be +2.0Hz unless an injection of this size causes a reduction in plant output that takes the operating point below **Designed Minimum Operating Level** in which case an appropriate injection should be calculated in accordance with the following:

For example, 0.9Hz is needed to take an initial output 65% to a final output of 20%. If the initial output was not 65% and the **Designed Minimum Operating Level** is not 20% then the injected step should be adjusted accordingly as shown in the example given below

Initial Output	65%
Designed Minimum Operating Level	20%
Frequency Controller Droop	4%
Frequency to be injected =	$(0.65 - 0.20) \times 0.04 \times 50 = 0.9\text{Hz}$

** Tests L and M in Figure 2 shall be conducted if in this range of tests the **System Frequency** feedback signal is replaced by the injection signal rather than the injection signal being added to the **System Frequency** signal. The tests will consist of monitoring the **Generating Unit** and **CCGT Module** in **Frequency Sensitive Mode** during normal **System Frequency** variations without applying any injection. Test N in figure 2 shall be conducted in all cases. All three tests should be conducted for a period of at least 10 minutes.

OC5.A.2.9 Compliance with CC.6.3.3 Functionality Test

- OC5.A.2.9.1 Where the plant design includes active control function or functions to deliver CC.6.3.3 compliance, the **Generator** will propose and agree a test procedure with **The Company**, which will demonstrate how the **Generating Unit Active Power** output responds to changes in **System Frequency** and ambient conditions (e.g. by **Frequency** and temperature injection methods).
- OC5.A.2.9.2 The **Generator** shall inform **The Company** if any load limiter control is additionally employed.
- OC5.A.2.9.3 With reference to the signals specified in OC5.A.1, **The Company** will agree with the **Generator** which additional control system parameters shall be monitored to demonstrate the functionality of CC.6.3.3 compliance systems. Where **The Company** recording equipment is not used, results shall be supplied to **The Company** in an electronic spreadsheet format.

APPENDIX 3 - COMPLIANCE TESTING OF POWER PARK MODULES (AND OTSUA)

OC5.A.3.1 Scope

OC5.A.3.1.1 This Appendix outlines the general testing requirements for **Power Park Modules** and **OTSUA** to demonstrate compliance with the relevant aspects of the **Grid Code**, **Ancillary Services Agreement** and **Bilateral Agreement** and apply only to **GB Generators**. The testing requirements applicable to **EU Generators** are specified in ECP.A.6. The tests specified in this Appendix will normally be sufficient to demonstrate compliance however **The Company** may:

- (i) agree an alternative set of tests provided **The Company** deem the alternative set of tests sufficient to demonstrate compliance with the **Grid Code**, **Ancillary Services Agreement** and **Bilateral Agreement**; and/or
- (ii) require additional or alternative tests if information supplied to **The Company** during the compliance process suggests that the tests in this Appendix will not fully demonstrate compliance with the relevant section of the **Grid Code**, **Ancillary Services Agreement** or **Bilateral Agreement**; and/or
- (ii) require additional tests if a **Power System Stabiliser** is fitted; and/or
- (iv) agree a reduced set of tests if a relevant **Manufacturer's Data & Performance Report** has been submitted to and deemed to be appropriate by **The Company**; and/or
- (v) agree a reduced set of tests for subsequent **Power Park Modules** or **OTSUA** following successful completion of the first **Power Park Module** or **OTSUA** tests in the case of a **Power Station** comprised of two or more **Power Park Modules** or **OTSUA** which **The Company** reasonably considers to be identical.

If:

- (a) the tests performed pursuant to OC5.A.3.1.1(iv) do not replicate the results contained in the **Manufacturer's Data & Performance Report** or
- (b) the tests performed pursuant to OC5.A.3.1.1(v) in respect of subsequent **Power Park Modules** or **OTSUA** do not replicate the full tests for the first **Power Park Module** or **OTSUA**, or
- (c) any of the tests performed pursuant to OC5.A.3.1.1(iv) or OC5.A.3.1.1(v) do not fully demonstrate compliance with the relevant aspects of the **Grid Code**, **Ancillary Services Agreement** and / or **Bilateral Agreement**,

then notwithstanding the provisions above, the full testing requirements set out in this Appendix will be applied.

OC5.A.3.1.2 The **Generator** is responsible for carrying out the tests set out in and in accordance with this Appendix and the **Generator** retains the responsibility for the safety of personnel and plant during the test. **The Company** will witness all of the tests outlined or agreed in relation to this Appendix unless **The Company** decides and notifies the **Generator** owner otherwise. Reactive Capability tests may be witnessed by **The Company** remotely from the **The Company** control centre. For all on site during **The Company** witnessed tests, the **Generator** must ensure suitable representatives from the **Generator** and / or **Power Park Module** manufacturer (if appropriate) and/or **OTSUA** manufacturer (if appropriate) are available on site for the entire testing period. In all cases and in addition to any recording of signals conducted by **The Company**, the **Generator** shall record all relevant test signals as outlined in OC5.A.1.

OC5.A.3.1.3 In addition to the dynamic signals supplied in OC5.A.1, the **Generator** shall inform **The Company** of the following information prior to the commencement of the tests and any changes to the following, if any values change during the tests:

- (i) All relevant transformer tap numbers; and
- (ii) Number of **Power Park Units** in operation

- OC5.A.3.1.4 The **Generator** shall submit a detailed schedule of tests to **The Company** in accordance with CP.6.3.1, and this Appendix.
- OC5.A.3.1.5 Prior to the testing of a **Power Park Module** or **OTSUA**, the **Generator** shall complete the **Integral Equipment Tests** procedure in accordance with OC.7.5.
- OC5.A.3.1.6 Partial **Power Park Module** or **OTSUA** testing as defined in OC5.A.3.2 and OC5.A.3.3 is to be completed at the appropriate stage in accordance with CP.6.
- OC5.A.3.1.7 Full **Power Park Module** or **OTSUA** testing as required by CP.7.2 is to be completed as defined in OC5.A.3.4 through to OC5.A.3.7.
- OC5.A.3.1.8 Where **OTSDUW Arrangements** apply and prior to the **OTSUA Transfer Time**, any relevant **OTSDUW Plant and Apparatus** shall be considered within the scope of testing described in this Appendix. Performance shall be assessed against the relevant Grid Code requirements for **OTSDUW Plant and Apparatus** at the **Interface Point** and other **Generator Plant and Apparatus** at the **Offshore Grid Entry Point**. This Appendix should be read accordingly.
- OC5.A.3.2 Pre 20% (or <50MW) **Synchronised Power Park Module** basic Voltage Control Tests
- OC5.A.3.2.1 Before 20% of the **Power Park Module** (or 50MW if less) has commissioned, either voltage control test OC5.A.3.5.6(i) or (ii) must be completed in accordance with CP.6.
- OC5.A.3.2.2 In the case of an **Offshore Power Park Module** which provides all or a portion of the **Reactive Power** capability as described in CC.6.3.2(e)(iii) and / or voltage control requirements as described in CC.6.3.8(b)(ii) to enable an **Offshore Transmission Licensee** to meet the requirements of **STC** Section K, the **Generator** is required to cooperate with the **Offshore Transmission Licensee** to conduct the 20% voltage control test. The results in relation to the **Offshore Power Park Module** will be assessed against the requirements in the **Bilateral Agreement**. In the case of **OTSUA** prior to the **OTSUA Transfer Time**, the **Generator** shall conduct the testing by reference to the entire control system responding to changes at the **Interface Point**.
- OC5.A.3.3 For **Power Park Modules** with a **Registered Capacity** $\geq 100\text{MW}$, pre 70% **Power Park Module** Tests
- OC5.A.3.3.1 Before 70% but with at least 50% of the **Power Park Module** commissioned, the following **Limited Frequency Sensitive** tests as detailed in OC5.A.3.6.2 must be completed.
- (a) BC3
- (b) BC4
- OC5.A.3.4 Reactive Capability Test
- OC5.A.3.4.1 This section details the procedure for demonstrating the reactive capability of an **Onshore Power Park Module** or an **Offshore Power Park Module** or **OTSUA** which provides all or a portion of the **Reactive Power** capability as described in CC.6.3.2(e)(iii) (for the avoidance of doubt, an **Offshore Power Park Module** which does not provide part of the **Offshore Transmission Licensee Reactive Power** capability as described in CC6.3.2(e)(i) and CC6.3.2(e)(ii) should complete the reactive power transfer / voltage control tests as per section OC5.A.3.8). These tests should be scheduled at a time where there are at least 95% of the **Power Park Units** within the **Power Park Module** in service. There should be sufficient MW resource forecasted in order to generate at least 85% of **Registered Capacity** of the **Power Park Module**.
- OC5.A.3.4.2 The tests shall be performed by modifying the voltage set-point of the voltage control scheme of the **Power Park Module** or **OTSUA** by the amount necessary to demonstrate the required reactive range. This is to be conducted for the operating points and durations specified in OC5.A.3.4.5.
- OC5.A.3.4.3 **Embedded Generators** should liaise with the relevant **Network Operator** to ensure the following tests will not have an adverse impact upon the **Network Operator's System** as per OC.7.5. In situations where the tests have an adverse impact upon the **Network Operator's System**, **The Company** will only require demonstration within the acceptable limits of the **Network Operator**. For the avoidance of doubt, these tests do not negate the requirement to produce a complete **Power Park Module** performance chart as specified in OC2.4.2.1

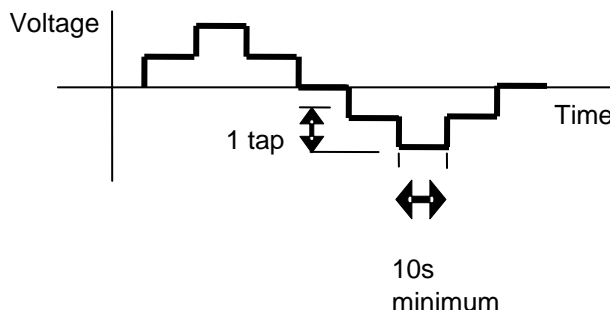
- OC5.A.3.4.4 In the case where the **Reactive Power** metering point is not at the same location as the **Reactive Power** capability requirement, then an equivalent **Reactive Power** capability for the metering point shall be agreed between the **Generator** and **The Company**.
- OC5.A.3.4.5 The following tests shall be completed:
- (i) Operation in excess of 50% **Rated MW** and maximum continuous lagging **Reactive Power** for 60 minutes.
 - (ii) Operation in excess of 50% **Rated MW** and maximum continuous leading **Reactive Power** for 60 minutes.
 - (iii) Operation at 50% **Rated MW** and maximum continuous leading **Reactive Power** for 5 minutes.
 - (iv) Operation at 20% **Rated MW** and maximum continuous leading **Reactive Power** for 5 minutes.
 - (v) Operation at 20% **Rated MW** and maximum continuous lagging **Reactive Power** for 5 minutes.
 - (vi) Operation at less than 20% **Rated MW** and unity **Power Factor** for 5 minutes. This test only applies to systems which do not offer voltage control below 20% of **Rated MW**.
 - (vii) Operation at 0% **Rated MW** and maximum continuous leading **Reactive Power** for 5 minutes. This test only applies to systems which offer voltage control below 20% and hence establishes actual capability rather than required capability.
 - (viii) Operation at 0% **Rated MW** and maximum continuous lagging **Reactive Power** for 5 minutes. This test only applies to systems which offer voltage control below 20% and hence establishes actual capability rather than required capability.
- OC5.A.3.4.6 Within this **OC5** lagging **Reactive Power** is the export of **Reactive Power** from the **Power Park Module** to the **Total System** and leading **Reactive Power** is the import of **Reactive Power** from the **Total System** to the **Power Park Module** or **OTSUA**.
- OC5.A.3.4.7 Where the **Generator** provides a report from a **Power Park Unit** manufacturer validating the full **Reactive Power** capability envelope of the **Power Park Unit** by test results acceptable to **The Company**, **The Company** may agree a reduction from the set of tests detailed in OC5.A.3.4.5. The validation testing detailed in the report must fully demonstrate the **Reactive Power** capability across both the **Active Power** range and the range of unit terminal voltages.
- OC5.A.3.5 Voltage Control Tests
- OC5.A.3.5.1 This section details the procedure for conducting voltage control tests on **Onshore Power Park Modules** or **OTSUA** or an **Offshore Power Park Module** which provides all or a portion of the voltage control capability as described in CC.6.3.8(b)(ii) (for the avoidance of doubt, **Offshore Power Park Modules** which do not provide part of the **Offshore Transmission Licensee** voltage control capability as described in CC6.3.8(b)(i) should complete the reactive power transfer / voltage control tests as per section OC5.A.3.8). These tests should be scheduled at a time when there are at least 95% of the **Power Park Units** within the **Power Park Module** in service. There should be sufficient MW resource forecasted in order to generate at least 65% of **Registered Capacity** of the **Onshore Power Park Module**. An **Embedded Generator** should also liaise with the relevant **Network Operator** to ensure all requirements covered in this section will not have a detrimental effect on the **Network Operator's System**.
- OC5.A.3.5.2 The voltage control system shall be perturbed with a series of step injections to the **Power Park Module** voltage reference, and where possible, multiple up-stream transformer taps. In the case of an **Offshore Power Park Module** providing part of the **Offshore Transmission Licensee** voltage control capability, this may require a series of step injections to the voltage reference of the **Offshore Transmission Licensee** control system.
- OC5.A.3.5.3 For steps initiated using network tap changers, the **Generator** will need to coordinate with **The Company** or the relevant **Network Operator** as appropriate. The time between transformer taps shall be at least 10 seconds as per OC5.A.3.5 Figure 1.

OC5.A.3.5.4 For step injections into the **Power Park Module** or **OTSUA** voltage reference, steps of $\pm 1\%$ and $\pm 2\%$ shall be applied to the voltage control system reference summing junction. The injection shall be maintained for 10 seconds as per OC5.A.3.5 Figure 2.

OC5.A.3.5.5 Where the voltage control system comprises of discretely switched **Plant** and **Apparatus** additional tests will be required to demonstrate that its performance is in accordance with Grid Code and **Bilateral Agreement** requirements.

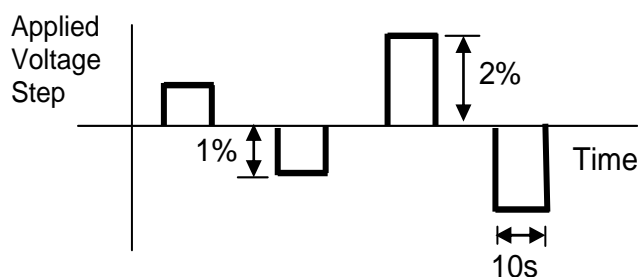
OC5.A.3.5.6 Tests to be completed:

(i)



OC5.A.3.5 Figure 1 – Transformer tap sequence for voltage control tests

(ii)



OC5.A.3.5 Figure 2 – Step injection sequence for voltage control tests

OC5.A.3.5.7 In the case of **OTSUA** where the **Bilateral Agreement** specifies additional damping facilities, additional testing to demonstrate these damping facilities may be required.

OC5.A.3.6 Frequency Response Tests

OC5.A.3.6.1 This section describes the procedure for performing frequency response testing on a **Power Park Module**. These tests should be scheduled at a time where there are at least 95% of the **Power Park Units** within the **Power Park Module** in service. There should be sufficient MW resource forecasted in order to generate at least 65% of **Registered Capacity** of the **Power Park Module**.

OC5.A.3.6.2 The frequency controller shall be in **Frequency Sensitive Mode** or **Limited Frequency Sensitive Mode** as appropriate for each test. Simulated frequency deviation signals shall be injected into the frequency controller reference/feedback summing junction. If the injected frequency signal replaces rather than sums with the real **System Frequency** signal then the additional tests outlined in OC5.A.3.6.6 shall be performed with the **Power Park Module** or **Power Park Unit** in normal **Frequency Sensitive Mode** monitoring actual **System Frequency**, over a period of at least 10 minutes. The aim of this additional test is to verify that the control system correctly measures the real **System Frequency** for normal variations over a period of time.

OC5.A.3.6.3 In addition to the frequency response requirements, it is necessary to demonstrate the **Power Park Module** ability to deliver a requested steady state power output which is not impacted by power source variation as per CC.6.3.9 or ECC.6.3.9. This test shall be conducted in **Limited Frequency Sensitive Mode** at a part-loaded output for a period of 10 minutes as per OC5.A.3.6.6.

Preliminary Frequency Response Testing

OC5.A.3.6.4 Prior to conducting the full set of tests as per OC5.A.3.6.6, **Generators** are required to conduct the preliminary set of tests below to confirm the frequency injection method is correct and the plant control performance is within expectation. The test numbers refer to Figure 1 below. The test should be conducted when sufficient MW resource is forecasted in order to generate at least 65% of **Registered Capacity** of the **Power Park Module**. The following frequency injections shall be applied when operating at module load point 4.

Test No (Figure 1)	Frequency Injection	Notes
8	<ul style="list-style-type: none"> Inject - 0.5Hz frequency fall over 10 sec Hold until conditions stabilise Remove the injected signal 	
14	<ul style="list-style-type: none"> Inject +0.5Hz frequency rise over 10 sec Hold until conditions stabilise Remove the injected signal 	
13	<ul style="list-style-type: none"> Inject -0.5Hz frequency fall over 10 sec Hold for a further 20 sec At 30 sec from the start of the test, Inject a +0.3Hz frequency rise over 30 sec. Hold until conditions stabilise Remove the injected signal 	

OC5.A.3.6.5 The recorded results (e.g. Finj, MW and control signals) should be sampled at a minimum rate of 1 Hz to allow **The Company** to assess the plant performance from the initial transients (seconds) to the final steady state conditions (5-15 minutes depending on the plant design). This is not witnessed by **The Company**. The **Generator** shall supply the recordings including data to **The Company** in an electronic spreadsheet format. Results shall be legible, identifiable by labelling, and shall have appropriate scaling.

Full Frequency Response Testing Schedule Witnessed by The Company

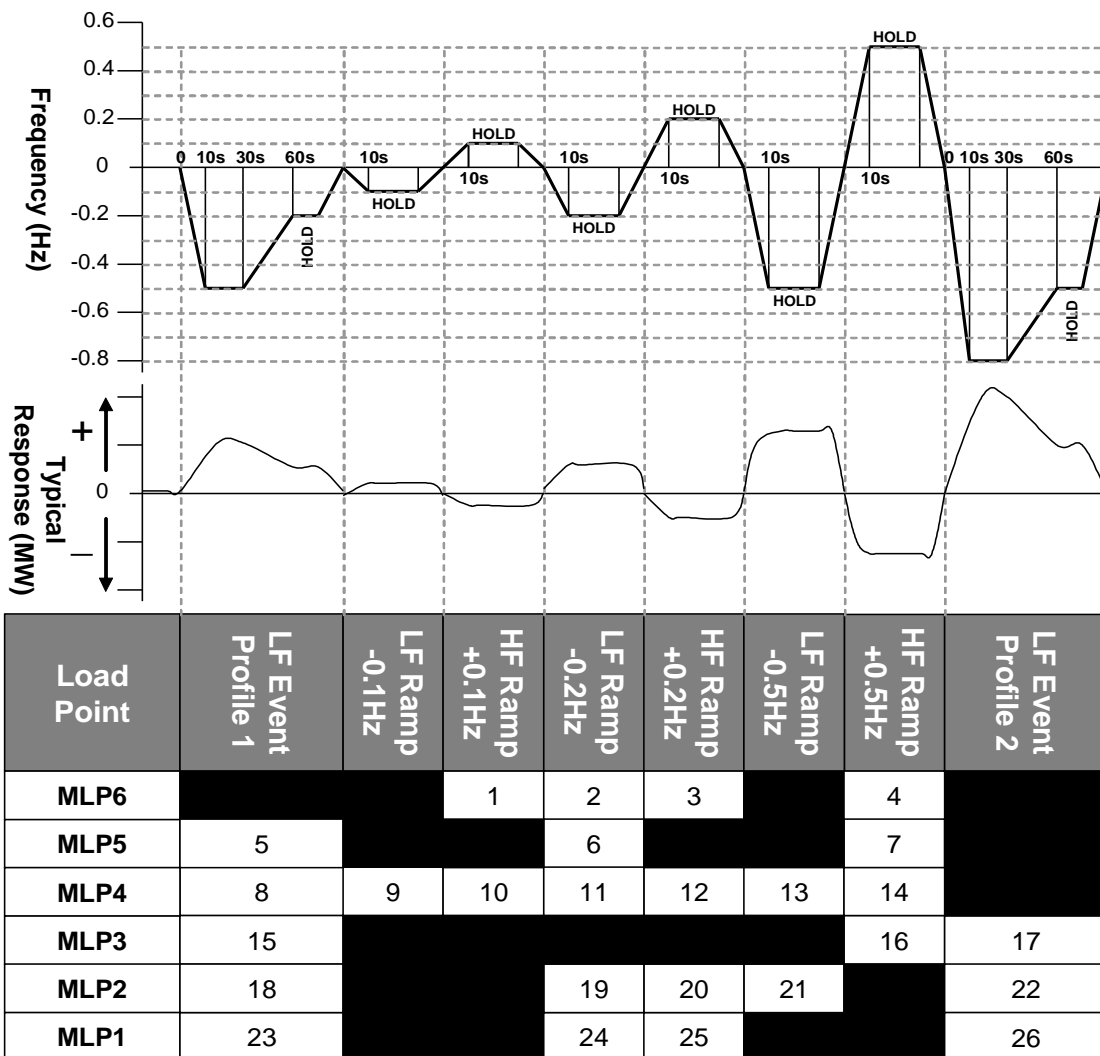
OC5.A.3.6.6 The tests are to be conducted at a number of different Module Load Points (MLP). In the case of a **Power Park Module** the module load points are conducted as shown below unless agreed otherwise by **The Company**.

Module Load Point 6 (Maximum Export Limit)	100% MEL
Module Load Point 5	90% MEL
Module Load Point 4 (Mid point of Operating Range)	80% MEL
Module Load Point 3	DMOL + 20%
Module Load Point 2 (Minimum Generation)	DMOL + 10%
Module Load Point 1 (Designed Minimum Operating Level)	DMOL

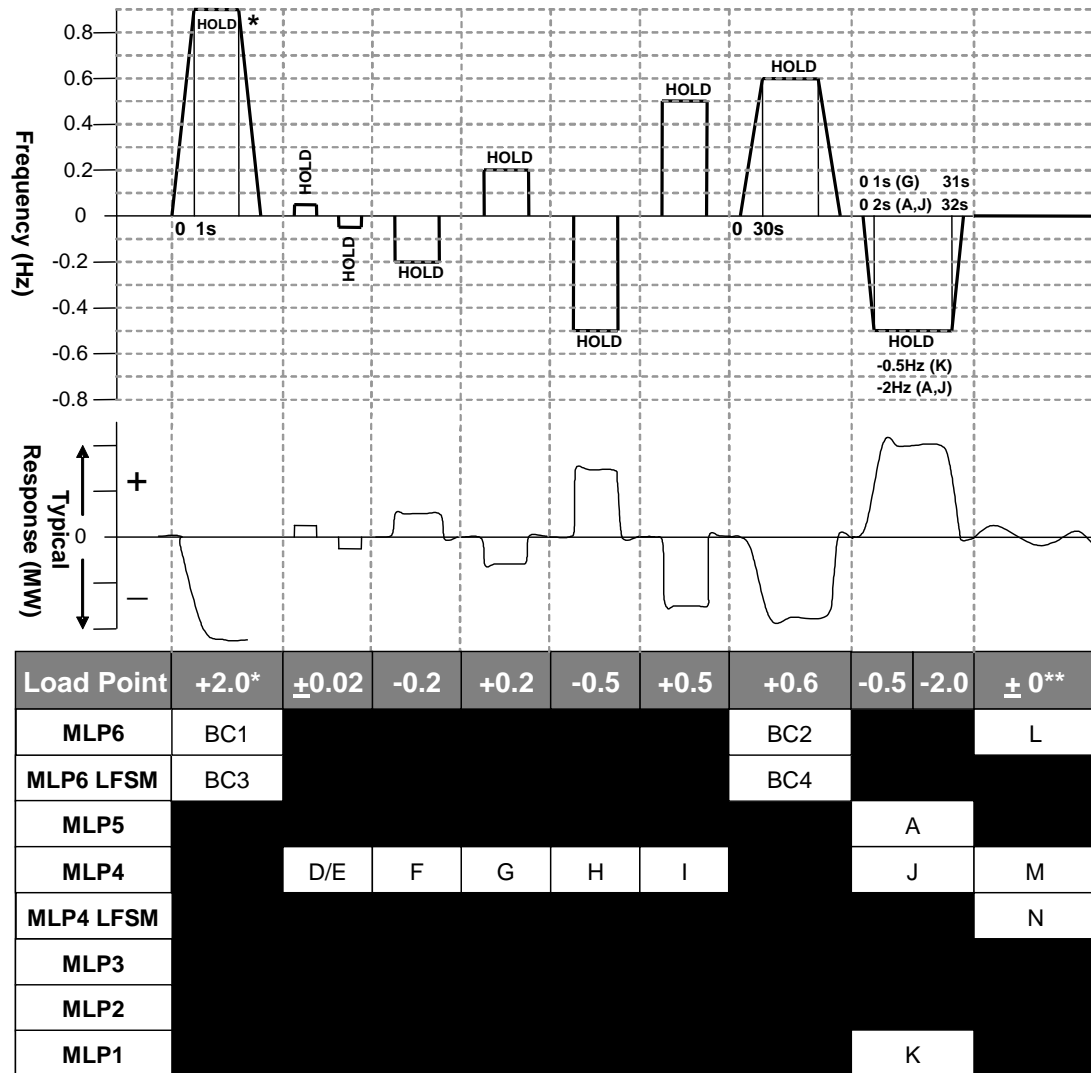
OC5.A.3.6.7 The tests are divided into the following two types;

- (i) Frequency response volume tests as per OC5.A.3.6. Figure 1. These tests consist of frequency profile and ramp tests.
- (ii) **System** islanding and step response tests as shown by OC5.A.3.6 Figure 2

OC5.A.3.6.8 There should be sufficient time allowed between tests for control systems to reach steady state (depending on available power resource). Where the diagram states 'HOLD' the current injection should be maintained until the **Active Power** (MW) output of the **Power Park Module** has stabilised. All frequency response tests should be removed over the same timescale for which they were applied. **The Company** may require repeat tests should the response volume be affected by the available power, or if tests give unexpected results.



OC5.A.3.6. Figure 1 – Frequency response volume tests



OC5.A.3.6. Figure 2 – System islanding and step response tests

* This will generally be +2.0Hz unless an injection of this size causes a reduction in plant output that takes the operating point below **Designed Minimum Operating Level** in which case an appropriate injection should be calculated in accordance with the following:

For example 0.9Hz is needed to take an initial output 65% to a final output of 20%. If the initial output was not 65% and the **Designed Minimum Operating Level** is not 20% then the injected step should be adjusted accordingly as shown in the example given below

Initial Output	65%
Designed Minimum Operating Level	20%
Frequency Controller Droop	4%
Frequency to be injected =	$(0.65 - 0.20) \times 0.04 \times 50 = 0.9\text{Hz}$

** Tests L and M in Figure 2 shall be conducted if in this range of tests the **System Frequency** feedback signal is replaced by the injection signal rather than the injection signal being added to the **System Frequency** signal. The tests will consist of monitoring the **Power Park Module** in **Frequency Sensitive Mode** during normal **System Frequency** variations without applying any injection. Test N in Figure 2 shall be conducted in all cases. All three tests should be conducted for a period of at least 10 minutes.

OC5.A.3.7 Fault Ride Through Testing

OC5.A.3.7.1 This section describes the procedure for conducting fault ride through tests on a single **Power Park Unit**.

OC5.A.3.7.2 The test circuit will utilise the full **Power Park Unit** with no exclusions (e.g. in the case of a wind turbine it would include the full wind turbine structure) and shall be conducted with sufficient resource available to produce at least 95% of the **Registered Capacity** of the **Power Park Unit**. The test will comprise of a number of controlled short circuits applied to a test network to which the **Power Park Unit** is connected, typically comprising of the **Power Park Unit** transformer and a test impedance to shield the connected network from voltage dips at the **Power Park Unit** terminals.

OC5.A.3.7.3 In each case, the tests should demonstrate the minimum voltage at the **Power Park Unit** terminals or **High Voltage** side of the **Power Park Unit** transformer which the **Power Park Unit** can withstand for the length of time specified in OC5.A.3.7.5. Any test results provided to **The Company** should contain sufficient data pre and post fault in order to determine steady state values of all signals, and the power recovery timescales.

OC5.A.3.7.4 In addition to the signals outlined in OC5.A.1.2. the following signals from either the **Power Park Unit** terminals or **High Voltage** side of the **Power Park Unit** transformer should be provided for this test only:

- (i) Phase voltages
- (ii) Positive phase sequence and negative phase sequence voltages
- (iii) Phase currents
- (iv) Positive phase sequence and negative phase sequence currents
- (v) Estimate of **Power Park Unit** negative phase sequence impedance
- (vi) MW – **Active Power** at the generating unit.
- (vii) MVA_r – **Reactive Power** at the generating unit.
- (viii) Mechanical Rotor Speed
- (ix) Real / reactive, current / power reference as appropriate
- (x) Fault ride through protection operation (e.g. a crowbar in the case of a doubly fed induction generator)
- (xi) Any other signals relevant to the control action of the fault ride through control deemed applicable for model validation.

At a suitable frequency rate for fault ride through tests as agreed with **The Company**.

OC5.A.3.7.5 The tests should be conducted for the times and fault types indicated in OC5.A.3.7 Table 1.

3 Phase	Phase to Phase	2 Phase to Earth	1 Phase to Earth	Grid Code Ref
0.14s	0.14s	0.14s	0.14s	CC.6.3.15a
0.384s				CC.6.3.15b
0.710s				
2.5s				
180.0s				

OC5.A.3.7 Table 1 – Types of fault for fault ride through **testing**

OC5.A.3.8 Reactive Power Transfer / Voltage Control Tests for Offshore Power Park Modules

OC5.A.3.8.1 In the case of an **Offshore Power Park Module** which provides all or a portion of the **Reactive Power** capability as described in CC.6.3.2(e)(iii) and / or voltage control requirements as described in CC.6.3.8(b)(ii) to enable an **Offshore Transmission Licensee** to meet the requirements of **STC** Section K, the testing, will comprise of the entire control system responding to changes at the onshore **Interface Point**. Therefore the tests in this section OC5.A.3.8 will not apply. The **Generator** shall cooperate with the relevant **Offshore Transmission Licensee** to facilitate these tests as required by **The Company**. The testing may be combined with testing of the corresponding **Offshore Transmission Licensee** requirements under the **STC**. The results in relation to the **Offshore Power Park Module** will be assessed against the requirements in the **Bilateral Agreement**.

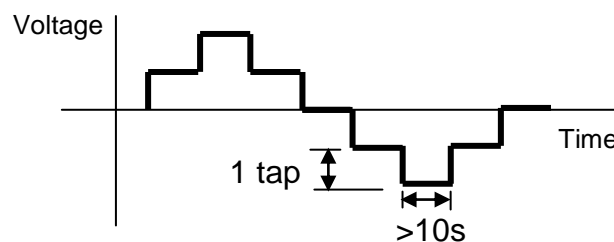
OC5.A.3.8.2 In the case of an **Offshore Power Park Module** which does not provide part of the **Offshore Transmission Licensee Reactive Power** capability the following procedure for conducting reactive power transfer control tests on **Offshore Power Park Modules** and / or voltage control system as per CC6.3.2(e)(i) and CC6.3.2(e)(ii) apply. These tests should be carried out prior to 20% of the **Power Park Units** within the **Offshore Power Park Module** being synchronised, and again when at least 95% of the **Power Park Units** within the **Offshore Power Park Module** in service. There should be sufficient power resource forecast to generate at least 85% of the **Registered Capacity** of the **Offshore Power Park Module**.

OC5.A.3.8.3 The **Reactive Power** control system shall be perturbed by a series of system voltage changes and changes to the **Active Power** output of the **Offshore Power Park Module**.

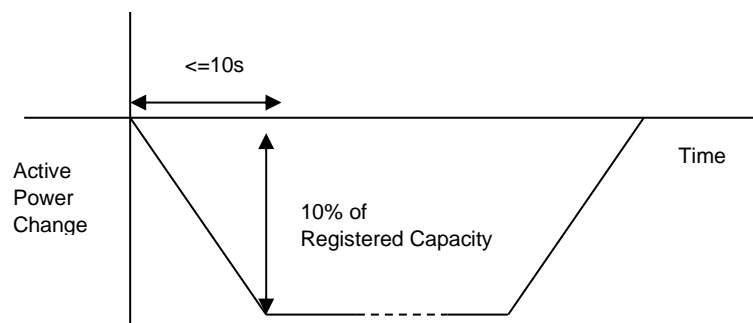
OC5.A.3.8.4 **System** voltage changes should be created by a series of multiple upstream transformer taps. The **Generator** should coordinate with **The Company** or the relevant **Network Operator** in order to conduct the required tests. The time between transformer taps should be at least 10 seconds as per OC5.A.3.8 Figure 1.

OC5.A.3.8.5 The **Active Power** output of the **Offshore Power Park Module** should be varied by applying a sufficiently large step to the frequency controller reference/feedback summing junction to cause a 10% change in output of the **Registered Capacity** of the **Offshore Power Park Module** in a time not exceeding 10 seconds. This test does not need to be conducted provided that the frequency response tests as outlined in OC5.A.3.6 are completed.

OC5.A.3.8.6 The following diagrams illustrate the tests to be completed:



OC5.A.3.8 Figure 1 – Transformer tap sequence for reactive transfer tests



OC5.A.3.8 Figure 2 – Active Power ramp for reactive transfer tests

APPENDIX 4 - COMPLIANCE TESTING FOR DC CONVERTERS AT A DC CONVERTER STATION

OC5.A.4.1 Scope

OC5.A.4.1.1 This Appendix outlines the general testing requirements for **DC Converter Station** owners to demonstrate compliance with the relevant aspects of the **Grid Code, Ancillary Services Agreement** and **Bilateral Agreement** and apply only to **DC Converter Station** owners. The testing requirements applicable to **HVDC System Owners** are specified in ECP.A.7. The tests specified in this Appendix will normally be sufficient to demonstrate compliance however **The Company** may:

- (i) agree an alternative set of tests provided **The Company** deem the alternative set of tests sufficient to demonstrate compliance with the **Grid Code, Ancillary Services Agreement** and **Bilateral Agreement**; and/or
- (ii) require additional or alternative tests if information supplied to **The Company** during the compliance process suggests that the tests in this Appendix will not fully demonstrate compliance with the relevant section of the **Grid Code, Ancillary Services Agreement** or **Bilateral Agreement**; and/or
- (iii) require additional tests if control functions to improve damping of power system oscillations and/or subsynchronous resonance torsional oscillations required by the **Bilateral Agreement** or included in the control scheme and active; and/or
- (iv) agree a reduced set of tests for subsequent **DC Converters** following successful completion of the first **DC Converter** tests in the case of a **Power Station** comprised of two or more **DC Converters** which **The Company** reasonably considers to be identical.

If:

- (a) the tests performed pursuant to OC5.A.4.1.1(iv) in respect of subsequent **DC Converters** do not replicate the full tests for the first **DC Converter**, or
- (b) any of the tests performed pursuant to OC5.A.4.1.1(iv) do not fully demonstrate compliance with the relevant aspects of the **Grid Code, Ancillary Services Agreement** and / or **Bilateral Agreement**,

then notwithstanding the provisions above, the full testing requirements set out in this Appendix will be applied.

OC5.A.4.1.2 The **DC Converter Station** owner is responsible for carrying out the tests set out in and in accordance with this Appendix and the **DC Converter Station** owner retains the responsibility for the safety of personnel and plant during the test. The **DC Converter Station** owner is responsible for ensuring that suitable arrangements are in place with the **Externally Interconnected System Operator** to facilitate testing. **The Company** will witness all of the tests outlined or agreed in relation to this Appendix unless **The Company** decides and notifies the **DC Converter Station** owner otherwise. Reactive Capability tests if required, may be witnessed by **The Company** remotely from the **The Company** control centre. For all on site **The Company** witnessed tests the **DC Converter Station** owner must ensure suitable representatives from the **DC Converter Station** owner and / or **DC Converter** manufacturer (if appropriate) are available on site for the entire testing period. In all cases and in addition to any recording of signals conducted by **The Company** the **DC Converter Station** owner shall record all relevant test signals as outlined in OC5.A.1.

OC5.A.4.1.3 In addition to the dynamic signals supplied in OC5.A.1 the **DC Converter Station** owner shall inform **The Company** of the following information prior to the commencement of the tests and any changes to the following, if any values change during the tests:

- (i) All relevant transformer tap numbers.

OC5.A.4.1.4 The **DC Converter Station** owner shall submit a detailed schedule of tests to **The Company** in accordance with CP.6.3.1, and this Appendix.

- OC5.A.4.1.5 Prior to the testing of a **DC Converter** the **DC Converter Station** owner shall complete the **Integral Equipment Tests** procedure in accordance with OC.7.5
- OC5.A.4.1.6 Full **DC Converter** testing as required by CP.7.2 is to be completed as defined in OC5.A.4.2 through to OC5.A.4.5
- OC5.A.4.2 Reactive Capability Test
- OC5.A.4.2.1 This section details the procedure for demonstrating the reactive capability of an **Onshore DC Converter**. These tests should be scheduled at a time where there are sufficient MW resource forecasted in order to import and export full **Registered Capacity** of the **DC Converter**.
- OC5.A.4.2.2 The tests shall be performed by modifying the voltage set-point of the voltage control scheme of the **DC Converter** by the amount necessary to demonstrate the required reactive range. This is to be conducted for the operating points and durations specified in OC5.A.4.2.5.
- OC5.A.4.2.3 **Embedded DC Converter Station** owner should liaise with the relevant **Network Operator** to ensure the following tests will not have an adverse impact upon the **Network Operator's System** as per OC.7.5. In situations where the tests have an adverse impact upon the **Network Operator's System**, **The Company** will only require demonstration within the acceptable limits of the **Network Operator**. For the avoidance of doubt, these tests do not negate the requirement to produce a complete **DC Converter** performance chart as specified in OC2.4.2.1.
- OC5.A.4.2.4 In the case where the **Reactive Power** metering point is not at the same location as the **Reactive Power** capability requirement, then an equivalent **Reactive Power** capability for the metering point shall be agreed between the **DC Converter Station** owner and **The Company**.
- OC5.A.4.2.5 The following tests shall be completed for both importing and exporting of **Active Power** for a **DC Converter** (excluding current source technology):
- (i) Operation at **Rated MW** and maximum continuous lagging **Reactive Power** for 60 minutes.
 - (ii) Operation at **Rated MW** and maximum continuous leading **Reactive Power** for 60 minutes.
 - (iii) Operation at 50% **Rated MW** and maximum continuous leading **Reactive Power** for 5 minutes.
 - (iv) Operation at 20% **Rated MW** and maximum continuous leading **Reactive Power** for 5 minutes.
 - (v) Operation at 20% **Rated MW** and maximum continuous lagging **Reactive Power** for 5 minutes.
 - (vi) Operation at less than 20% **Rated MW** and unity **Power Factor** for 5 minutes. This test only applies to systems which do not offer voltage control below 20% of **Rated MW**.
 - (vii) Operation at 0% **Rated MW** and maximum continuous leading **Reactive Power** for 5 minutes. This test only applies to systems which offer voltage control below 20% and hence establishes actual capability rather than required capability.
 - (viii) Operation at 0% **Rated MW** and maximum continuous lagging **Reactive Power** for 5 minutes. This test only applies to systems which offer voltage control below 20% and hence establishes actual capability rather than required capability.
- OC5.A.4.2.6 For the avoidance of doubt, lagging **Reactive Power** is the export of **Reactive Power** from the **DC Converter** to the **Total System** and leading **Reactive Power** is the import of **Reactive Power** from the **Total System** to the **DC Converter**.

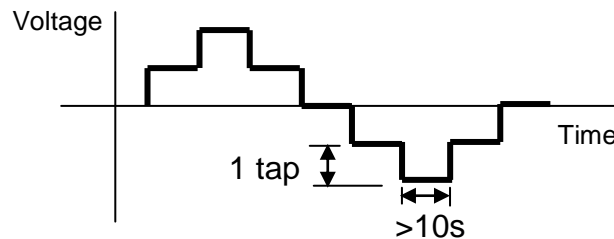
OC5.A.4.3 Reactive Control Testing For DC Converters (Current Source Technology)

OC5.A.4.3.1 The Reactive control testing for **DC Converters** employing current source technology shall be for both importing and exporting of **Active Power** and shall demonstrate that the **Reactive Power** transfer limits specified in the **Bilateral Agreement** are not exceeded. The **Reactive Power** control system shall be perturbed by a series of system voltage changes to the **Active Power** output of the **DC Converter** and changes of system voltage where possible. The **DC Converter Station** owner is responsible for ensuring that suitable arrangements are in place with the **Externally Interconnected System Operator** to facilitate the **Active Power** changes required by these tests

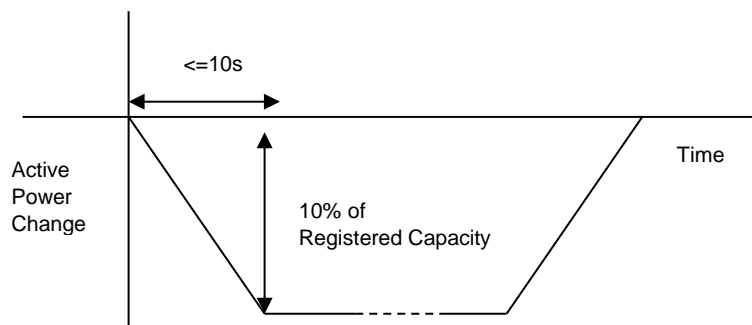
OC5.A.4.3.2 The **Active Power** output of the **DC Converter** should be varied by applying a sufficiently large step to the frequency controller reference/feedback summing junction to cause at least a 10% change in output of the **Registered Capacity** of the **DC Converter** in a time not exceeding 10 seconds. This test does not need to be conducted provided that the frequency response tests as outlined in OC5.A.4.3 are completed.

OC5.A.4.3.3 Where possible, **System** voltage changes should be created by a series of multiple upstream transformer taps. The **DC Converter station** owner should coordinate with **The Company** or the relevant **Network Operator** in order to conduct the required tests. The time between transformer taps should be at least 10 seconds as per OC5.A.4.3 Figure 1.

OC5.A.4.3.4 The following diagrams illustrate the tests to be completed:



OC5.A.4.3 Figure 1 – Transformer tap sequence for reactive transfer tests



OC5.A.4.3 Figure 2 – Active Power ramp for reactive transfer tests

OC5.A.4.4 Voltage Control Tests

OC5.A.4.4.1 This section details the procedure for conducting voltage control tests on **DC Converters** (excluding current source technology). These tests should be scheduled at a time where there is sufficient MW resource in order to import and export full **Registered Capacity** of the **DC Converter**. An **Embedded DC Converter Station** owner should also liaise with the relevant **Network Operator** to ensure all requirements covered in this section will not have a detrimental effect on the **Network Operator's System**.

OC5.A.4.4.2 The voltage control system shall be perturbed with a series of step injections to the **DC Converter** voltage reference, and where possible, multiple up-stream transformer taps.

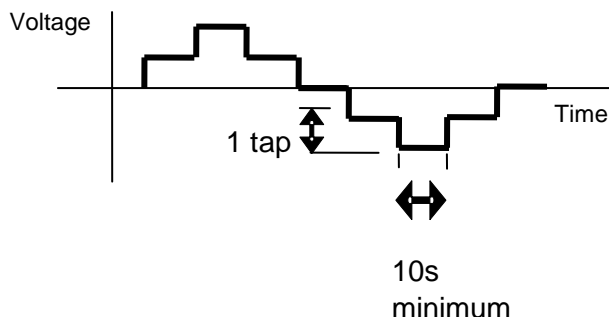
OC5.A.4.4.3 For steps initiated using network tap changers, the **DC Converter Station** owner will need to coordinate with **The Company** or the relevant **Network Operator** as appropriate. The time between transformer taps shall be at least 10 seconds as per OC5.A.4.4 Figure 1.

OC5.A.4.4.4 For step injections into the **DC Converter** voltage reference, steps of $\pm 1\%$ and $\pm 2\%$ shall be applied to the voltage control system reference summing junction. The injection shall be maintained for 10 seconds as per OC5.A.4.4 Figure 2.

OC5.A.4.4.5 Where the voltage control system comprises of discretely switched **Plant** and **Apparatus**, additional tests will be required to demonstrate that its performance is in accordance with **Grid Code** and **Bilateral Agreement** requirements.

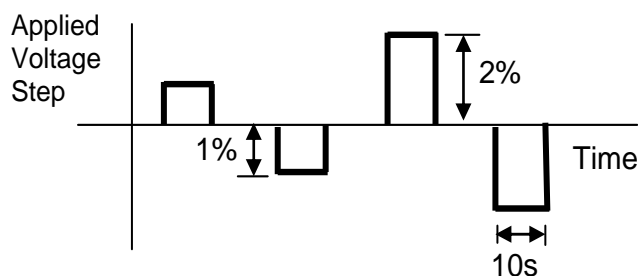
OC5.A.4.4.6 Tests to be completed:

(i)



OC5.A.4.4 Figure 1 – Transformer tap sequence for voltage control tests

(ii)



OC5.A.4.4 Figure 2 – Step injection sequence for voltage control tests

OC5.A.4.5 Frequency Response Tests

OC5.A.4.5.1 This section describes the procedure for performing frequency response testing on a **DC Converter**. These tests should be scheduled at a time where there is sufficient MW resource in order to import and export full **Registered Capacity** of the **DC Converter**. The **DC Converter Station** owner is responsible for ensuring that suitable arrangements are in place with the **Externally Interconnected System Operator** to facilitate the **Active Power** changes required by these tests

OC5.A.4.5.2 The frequency controller shall be in **Frequency Sensitive Mode** or **Limited Frequency Sensitive Mode** as appropriate for each test. Simulated frequency deviation signals shall be injected into the frequency controller reference/feedback summing junction. If the injected frequency signal replaces rather than sums with the real **System Frequency** signal then the additional tests outlined in OC5.A.4.5.6 shall be performed with the **DC Converter** in normal **Frequency Sensitive Mode** monitoring actual system frequency, over a period of at least 10 minutes. The aim of this additional test is to verify that the control system correctly measures the real **System Frequency** for normal variations over a period of time.

OC5.A.4.5.3 In addition to the frequency response requirements it is necessary to demonstrate the **DC Converter** ability to deliver a requested steady state power output which is not impacted by power source variation as per CC.6.3.9. This test shall be conducted in **Limited Frequency Sensitive Mode** at a part-loaded output for a period of 10 minutes as per OC5.A.4.5.6.

Preliminary Frequency Response Testing

OC5.A.4.5.4 Prior to conducting the full set of tests as per OC5.A.4.5.6, **DC Converter Station** owners are required to conduct a preliminary set of tests below to confirm the frequency injection method is correct and the plant control performance is within expectation. The test numbers refer to Figure 1 below. These tests should be scheduled at a time where there is sufficient MW resource in order to export full **Registered Capacity** from the **DC Converter**. The following frequency injections shall be applied when operating at module load point 4.

Test No (Figure 1)	Frequency Injection	Notes
8	<ul style="list-style-type: none"> Inject - 0.5Hz frequency fall over 10 sec Hold until conditions stabilise Remove the injected signal 	
14	<ul style="list-style-type: none"> Inject +0.5Hz frequency rise over 10 sec Hold until conditions stabilise Remove the injected signal 	
13	<ul style="list-style-type: none"> Inject -0.5Hz frequency fall over 10 sec Hold for a further 20 sec At 30 sec from the start of the test, Inject a +0.3Hz frequency rise over 30 sec. Hold until conditions stabilise Remove the injected signal 	

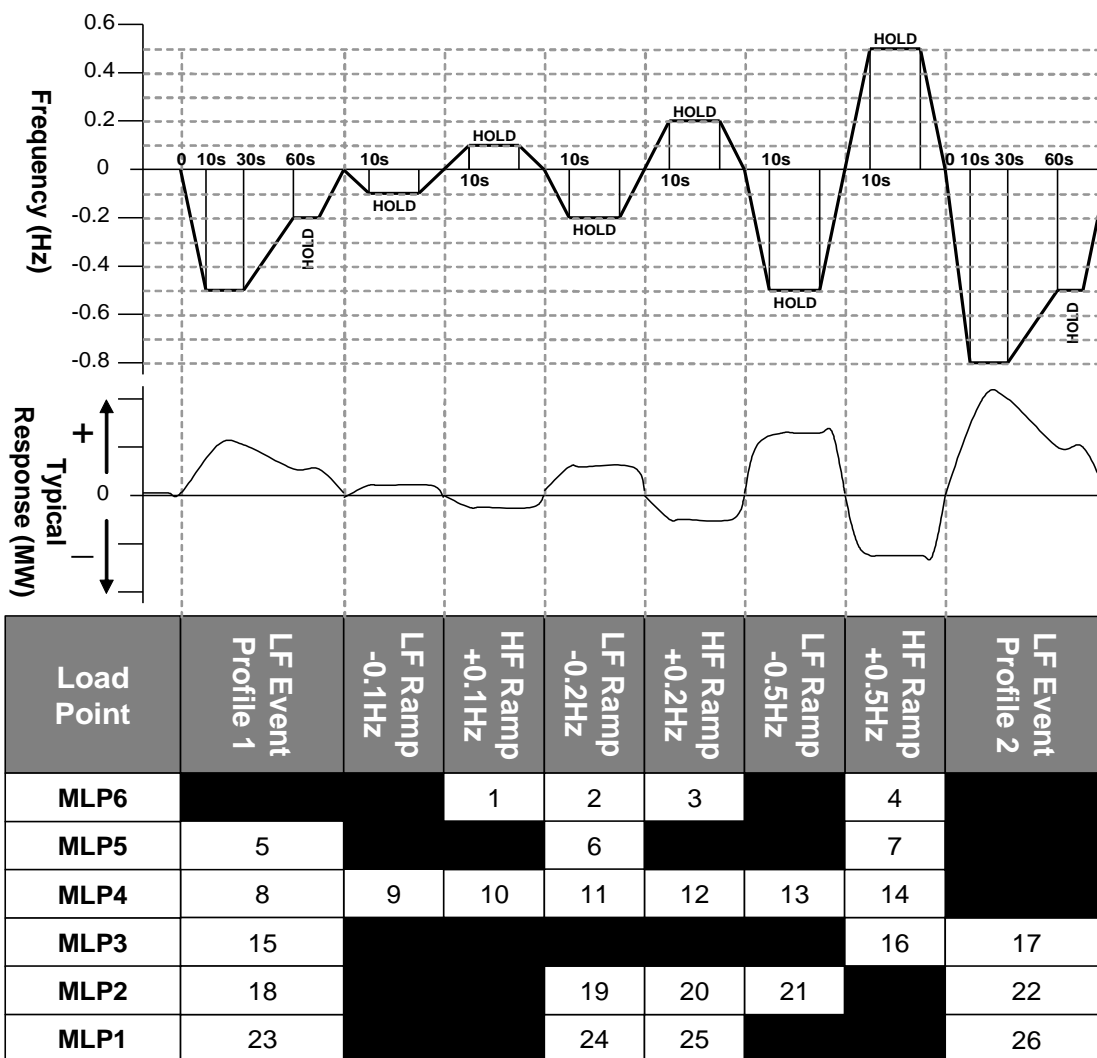
OC5.A.4.5.5 The recorded results (e.g. Finj, MW and control signals) should be sampled at a minimum rate of 1 Hz to allow **The Company** to assess the plant performance from the initial transients (seconds) to the final steady state conditions (5-15 minutes depending on the plant design). This is not witnessed by **The Company**. The **DC Converter Station** owner shall supply the recordings including data to **The Company** in an electronic spreadsheet format. Results shall be legible, identifiable by labelling, and shall have appropriate scaling.

Full Frequency Response Testing Schedule Witnessed by **The Company**

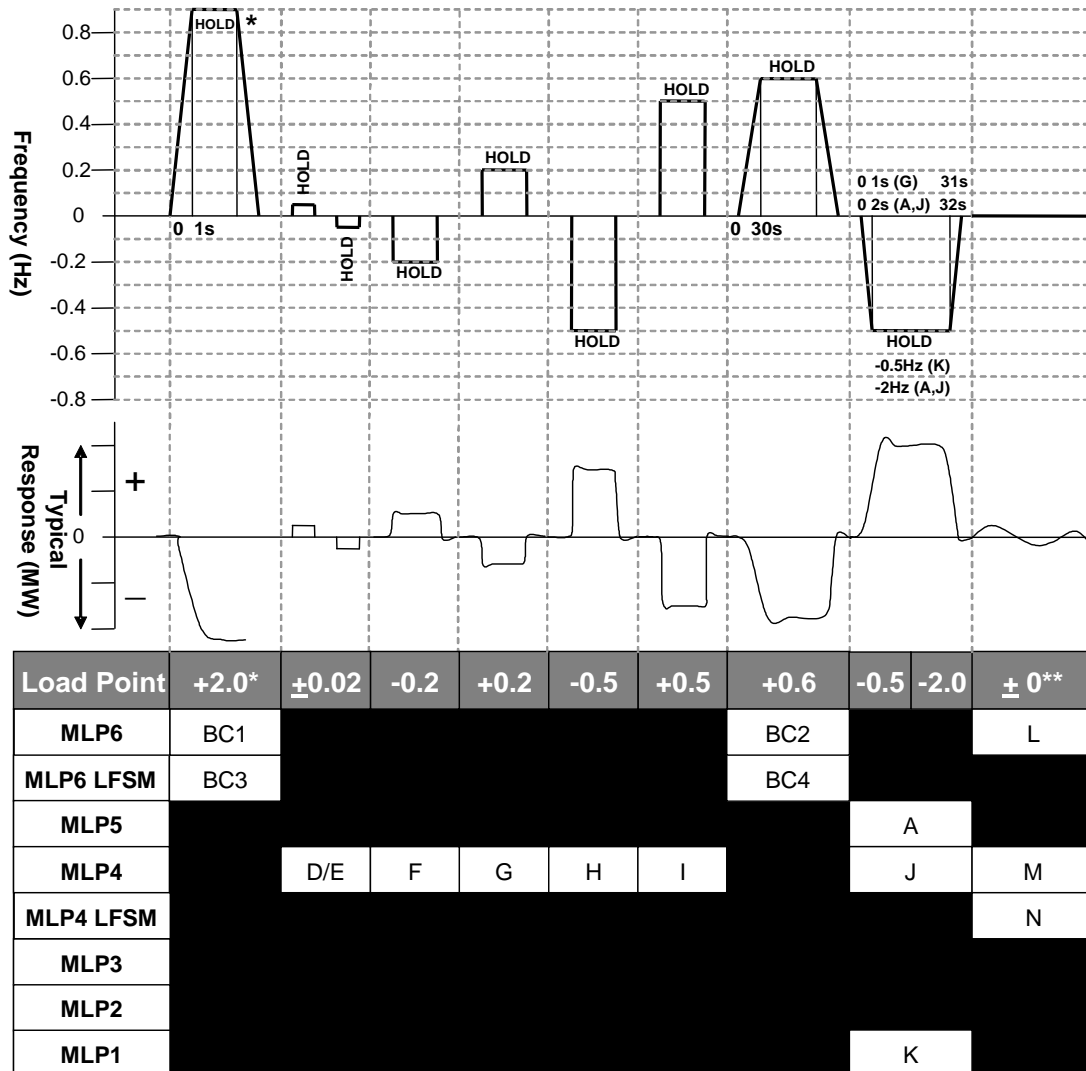
OC5.A.4.5.6 The tests are to be conducted at a number of different Module Load Points (MLP). In the case of a **DC Converter** the module load points are conducted as shown below unless agreed otherwise by **The Company**.

Module Load Point 6 (Maximum Export Limit)	100% MEL
Module Load Point 5	90% MEL
Module Load Point 4 (Mid point of Operating Range)	80% MEL
Module Load Point 3	DMOL + 20%
Module Load Point 2 (Minimum Generation)	DMOL + 10%
Module Load Point 1 (Designed Minimum Operating Level)	DMOL

- OC5.A.4.5.7 The tests are divided into the following two types;
- (i) **Frequency** response volume tests as per OC5.A.4.5. Figure 1. These tests consist of frequency profile and ramp tests.
 - (ii) **System** islanding and step response tests as shown by OC5.A.4.5 Figure 2
- OC5.A.4.5.8 There should be sufficient time allowed between tests for control systems to reach steady state (depending on available power resource). Where the diagram states 'HOLD' the current injection should be maintained until the **Active Power** (MW) output of the **DC Converter** has stabilised. All frequency response tests should be removed over the same timescale for which they were applied. **The Company** may require repeat tests should the response volume be affected by the available power, or if tests give unexpected results.



OC5.A.4.5. Figure 1 – Frequency response volume tests



OC5.A.4.5. Figure 2 – System islanding and step response tests

* This will generally be +2.0Hz unless an injection of this size causes a reduction in plant output that takes the operating point below the **Designed Minimum Operating Level** in which case an appropriate injection should be calculated in accordance with the following:

For example 0.9Hz is needed to take an initial output of 65% to a final output of 20%. If the initial output was not 65% and the **Designed Minimum Operating Level** is not 20% then the injected step should be adjusted accordingly as shown in the example given below

Initial Output	65%
Designed Minimum Operating Level	20%
Frequency Controller Droop	4%
Frequency to be injected =	$(0.65 - 0.20) \times 0.04 \times 50 = 0.9\text{Hz}$

** Tests L and M in Figure 2 shall be conducted if in this range of tests the **System Frequency** feedback signal is replaced by the injection signal rather than the injection signal being added to the **System Frequency** signal. The tests will consist of monitoring the **DC Converter** in **Frequency Sensitive Mode** during normal **System Frequency** variations without applying any injection. Test N in Figure 2 shall be conducted in all cases. All three tests should be conducted for a period of at least 10 minutes.

< END OF OPERATING CODE NO. 5 >

REVISIONS

(R)

(This section does not form part of the Grid Code)

- R.1 **The Company's Transmission Licence** sets out the way in which changes to the Grid Code are to be made and reference is also made to **The Company's** obligations under the General Conditions.
- R.2 All pages re-issued have the revision number on the lower left hand corner of the page and date of the revision on the lower right hand corner of the page.
- R.3 The Grid Code was introduced in March 1990 and the first issue was revised 31 times. In March 2001 the New Electricity Trading Arrangements were introduced and Issue 2 of the Grid Code was introduced which was revised 16 times. At British Electricity Trading and Transmission Arrangements (BETTA) Go-Active Issue 3 of the Grid Code was introduced and subsequently revised 35 times. At Offshore Go-active Issue 4 of the Grid Code was introduced and has been revised 13 times since its original publication. Issue 5 of the Grid Code was published to accommodate the changes made by Grid Code Modification A/10 which has incorporated the **Generator** compliance process into the Grid Code, which was revised 47 times. Issue 6 was published to incorporate all the non-material amendments as a result of modification GC0136.
- R.4 This Revisions section provides a summary of the sections of the Grid Code changed by each revision to Issue 6.
- R.5 All enquiries in relation to revisions to the Grid Code, including revisions to Issues 1, 2, 3, 4 and 5 should be addressed to the Grid Code development team at the following email address:
Grid.Code@nationalgrideso.com

Revision	Section	Related Modification	Effective Date
0	Glossary Definitions	GC0136	05 March 2021
0	Planning Code	GC0136	05 March 2021
0	Connection Conditions	GC0136	05 March 2021
0	European Connection Conditions	GC0136	05 March 2021
0	Demand Response Services	GC0136	05 March 2021
0	Compliance Processes	GC0136	05 March 2021
0	Europeans Compliance Processes	GC0136	05 March 2021
0	Operating Code 1	GC0136	05 March 2021
0	Operating Code 2	GC0136	05 March 2021
0	Operating Code 5	GC0136	05 March 2021
0	Operating Code 6	GC0136	05 March 2021
0	Operating Code 7	GC0136	05 March 2021
0	Operating Code 8	GC0136	05 March 2021
0	Operating Code 8A	GC0136	05 March 2021
0	Operating Code 8B	GC0136	05 March 2021
0	Operating Code 9	GC0136	05 March 2021
0	Operating Code 11	GC0136	05 March 2021
0	Operating Code 12	GC0136	05 March 2021
0	Balancing Code 2	GC0136	05 March 2021

Revision	Section	Related Modification	Effective Date
0	Balancing Code 3	GC0136	05 March 2021
0	Balancing Code 4	GC0136	05 March 2021
0	Balancing Code 5	GC0136	05 March 2021
0	Data Registration Code	GC0136	05 March 2021
0	General Conditions	GC0136	05 March 2021
0	Governance Rules	GC0136	05 March 2021
1	Glossary Definitions	GC0130	18 March 2021
1	Operating Code 2	GC0130	18 March 2021
1	Data Registration Code	GC0130	18 March 2021
1	General Conditions	GC0130	18 March 2021
2	Glossary Definitions	GC0147	17 May 2021
2	Operating Code 6B	GC0147	17 May 2021
2	Operating Code 7	GC0147	17 May 2021
2	Balancing Code 1	GC0147	17 May 2021
2	Balancing Code 2	GC0147	17 May 2021
3	Balancing Code 2	GC0144	26 May 2021
3	Balancing Code 4	GC0144	26 May 2021
4	Preface	GC0149	03 August 2021
4	Glossary Definitions	GC0149	03 August 2021
4	Planning Code	GC0149	03 August 2021

Revision	Section	Related Modification	Effective Date
4	European Connection Conditions	GC0149	03 August 2021
4	European Compliance Processes	GC0149	03 August 2021
4	Demand Response Services Code	GC0149	03 August 2021
4	Operating Code 2	GC0149	03 August 2021
4	Balancing Code 4	GC0149	03 August 2021
4	Data Registration Code	GC0149	03 August 2021
4	Governance Rules	GC0149	03 August 2021
5	Operating Code 7	GC0109	23 August 2021
6	Connection Conditions	GC0134	1 September 2021
6	European Connection Conditions	GC0134	1 September 2021
6	Balancing Code 2	GC0134	1 September 2021
7	Operating Code 6B	GC0150	4 October 2021
8	Operating Code 2	GC0151	8 November 2021
8	Operating Code 3	GC0151	8 November 2021
8	Operating Code 5	GC0151	8 November 2021

< END OF REVISIONS >