WORKING GROUP REPORT

Compliance Working Group

Prepared by the Compliance Working Group
for submission to the Grid Code Review Panel

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I DOCUMENT CONTROL

a National Grid Document Control

Version	Date	Author	Change Reference
0.1	15/01/2009	NGET	Draft for Comment by Working Group Members
1	27/01/2009	NGET	Final including changes based on comments from Working Group Members

b Distribution

Name	Organisation
GCRP Members	GCRP
Compliance Working Group	GCRP WG

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1.0 Introduction

1.1 This report describes proposals to introduce into the Grid Code details of the processes that should be followed in assessing and ensuring compliance of generating plant with the requirements of the Grid Code.

2.0 Background

2.1 The Grid Code provisions specify, amongst other things, the requirements that apply to licensed generators connected to the GB Transmission System and DNO networks and, through links in the Distribution Code, to License Exempt Embedded Medium Power Stations (LEEMPS). These requirements relate to technical capabilities, the provision of planning data to NGET, and the submission of operational data. The provisions ensure that NGET is able to plan and operate the GB Transmission System in line with its Transmission Licence obligations.

2.2 Historically NGET has assessed compliance with the Grid Code requirements of generators with which it has contracts, both during the commissioning of new plant and throughout the operational life of existing plant. The assessment procedures and tests are not formally specified in documentation under industry governance, but in recent years NGET has issued Guidance Notes[1] describing these procedures and tests in order to raise their visibility and ensure consistency.

2.3 Following discussions at the GCRP it was agreed that there will be benefit in formally defining a process that should be followed by NGET and generators in assessing and demonstrating compliance with the Grid Code provisions. The Compliance Working Group was established to agree proposals to achieve this.

2.4 Based on a request from the DNOs, a review of the compliance arrangements for LEEMPS, including a possible transfer to NGET of some of the compliance responsibilities, was included in the remit of the compliance working group.

3.0 Technical Performance requirements

3.1 The Compliance Working Group agreed that some of the areas covered by the Guidance Notes[1] (issued by NGET and made available to the industry on its web site) were additional technical requirements rather than assessments against existing Grid Code provisions. Consequently the group undertook to consider and make recommendations in these areas separately as the first stage of its work. Resulting Grid Code modification proposals were consulted on in Autumn 2008 and a revised Grid Code was issued in December 2008.

4.0 Compliance assessment role

4.1 NGET undertakes compliance assessment of generators directly connected to the GB Transmission System and of licensed generators connected to DNO

[1] http://www.nationalgrid.com/NR/rdonlyres/6C036707-27A4-4C43-AD8A-777487AAAFFF/28685/GuidanceNotesforPowerParkDevelopersIssue2September.pdf
http://www.nationalgrid.com/NR/rdonlyres/B4DF2400-96FD-40E5-AF44-8DB88AADA5DF/28686/GuidanceNotesforSynchronousGeneratorsIssue11Septem.pdf

networks. The roles of NGET and DNOs in compliance assessment of LEEMPS has been subject to recent debate and it was agreed by the Compliance Working Group that clarification is required in this area. The group proposes that:

- By default NGET will undertake the compliance assessment of new LEEMPS up to the issue of a Final Operational Notification (described in paragraph 5.5). Subsequently the DNO will manage the ongoing (lifetime) compliance issues should they arise.

- A DNO may elect to take on the compliance assessment role for all of the new LEEMPS connecting to its networks.

- Unless otherwise agreed by all relevant parties, DNOs will undertake the compliance assessment of LEEMPS that have already begun the compliance assessment process.

4.2 For all power stations for which NGET undertakes the compliance assessment role, the compliance process followed will be specified in the Grid Code, as described below. In cases where the role is undertaken by the DNO, it will employ a process that it deems appropriate.

4.3 The responsibility for enforcing ongoing (lifetime) compliance of the LEEMPS plant, subsequent to the initial compliance assessment process of the new LEEMPS, will in all cases be the responsibility of the DNO. NGET and the DNOs are still discussing the details of how this should work in practice and whether any further minor amendments are needed to both D Code and G Code drafting to fully reflect pragmatic considerations.

4.4 Development of and consultation on the proposals for the offshore regime have progressed during the development of the proposals of the Compliance Working Group. The Grid Code requirements for offshore generators are not yet finalised; this is expected in Spring 2009. The Compliance Working Group proposes that the compliance assessment of offshore Power Park Modules will in principle be the same as for onshore power stations. It is proposed that testing will take place onshore, as effective testing requires high wind conditions, under which safe access to offshore platforms cannot be guaranteed. Due to the interaction between the two consultations (compliance and offshore regime), the Grid Code changes related to the compliance assessment of offshore generation are included in a separate appendix (appendix 3).

4.5 It is anticipated that the requirements for reactive power capability and voltage control will be different for offshore generators than for those onshore. This will require a different set of tests relating to these provisions between the two generation categories. These alternative tests, based on the current offshore regime proposals, are shown in appendix 3.

4.6 Some of the technical requirements for the Offshore Transmission System will be included in the SOTO code (STC), particularly STC Schedule K[1]. It is expected that the responsibility for compliance with these requirements will lie with the appointed OfTO, through their Transmission Licence. NGET will not be

[1] Schedule K is currently under development

responsible for compliance of the OfTO with any STC requirements, except for where NGET is appointed as the OfTO.

5.0 NGET Compliance process

5.1 The development and operation of power stations takes place over a number of years during which the plant may be in a number of states: being built, ready to energise its connection (commissioning), ready to be first synchronised to the system, proving the generation plant including performance testing, operating with capabilities fully in line with the Grid Code requirements (including any derogations), or subsequently operating for a period with some restricted capability.

5.2 NGET currently issues a variety of operational notifications to power station owners that indicate the operational status of its plant. The proposals developed by the Compliance Working Group formalise the use of these notifications, detail the processes that lead to issue of them, and specify any actions required as a result of them. Four notifications are proposed: Energisation Operational Notification (EON), Interim Operational Notification (ION), Limited Operational Notification (LON) and Final Operational Notification (FON).

5.3 To aid readers of the legal text, particularly to help individuals less familiar with the Grid Code, a set of illustrative diagrams for the compliance processes have been added in the legal text, see CC.A.9 (for new power stations), CC.A.10 (for new LEEMPS/DCCS where the NGET compliance option applies) and CC.A.11 (for ongoing compliance). These are intended to give an overview and for readers seeking answers to a particular compliance process question to be able to quickly locate the relevant part of the text.

5.4 An EON will be issued when the network to which the power station will connect is available and will confirm that the generator's plant may be energised from the network. This indicates completion of work by the network owner and the generator, in respect of its network to be energised. Prior to issue of an EON the generator will have submitted specified data, largely related to site safety, and declared its readiness to energise.

5.5 An ION will be issued to indicate that a generator may synchronise its plant to the system. An ION will be issued following submission to NGET by the generator of a self certification of compliance supplemented with specified data and documentation which demonstrates that the generator is expected to deliver compliant performance. In the case of synchronous generating units, the ION will indicate that the go ahead to synchronise is conditional upon demonstration of compliance with certain Connection Conditions (open circuit tests immediately before synchronising). The ION will be time limited and may contain restrictions on the operation of the power station, for example the number of turbines that may be connected in a wind farm may be limited until certain staged tests have been successfully completed. The ION is intended to cover the period during which the generator demonstrates full compliance with the Grid Code. If the readiness for energisation and synchronisation are broadly simultaneous, then the ION may be issued without the EON.

5.6 The issue of a FON indicates that the generator has demonstrated full

compliance with the requirements of the Grid Code, taking account of any relevant derogations. The FON is not time limited and does not contain restrictions.

5.7 It is acknowledged that during the normal operation of plant that has been issued with a FON, it will occasionally be subject to technical restrictions that limit its performance but do not prevent it generating. Once the generator is aware of the restriction it may require a period of assessment to determine whether the plant still meets the requirements of the Grid Code. If the plant capability is less than the Grid Code requirement, time is needed to carry out the necessary work to restore the capability. This time will vary greatly depending on the nature of the remedial work. Currently the generator should apply for a derogation to cover the period from first becoming aware of its inability to meet the requirements of Grid Code to restoration of the capability. As a large proportion of restrictions are quickly resolved the group agreed that a period of operation without derogation would be of benefit, to prevent the need to issue a large number of short term derogations, some of which may be resolved during the derogation consultation phase. It is proposed that a LON will be issued in such circumstances allowing a generator to operate with technical restrictions for up to twelve months, after which derogation will be needed. When operating to the terms of the LON, a generator will be deemed compliant with the Grid Code. Once the restriction is removed and compliance with the relevant Grid Code provision fully demonstrated, a FON will be issued.

5.8 The operational notifications will generally be issued to the generator by NGET. For LEEMPS, where NGET is undertaking the compliance assessment role, this includes the ION and FON. In this case the FON will state that the compliance relationship for the LEEMPS is now transferred to the DNO. For LEEMPS where the DNO is undertaking compliance, the DNO will issue its own documents to the LEEMPS owner. These documents will perform the equivalent function of the ION and FON issued by NGET elsewhere.

5.9 For all LEEMPS, the LON process will apply only between NGET and the DNO. The ongoing (lifetime) compliance at the interface between the DNO and the LEEMPS will always be the responsibility of the DNO.

5.10 New Grid Code text detailing the procedures relating to these Operational Notifications is included in conditions CC.4.1 to C.C.4.6.

6.0 Demonstration of compliance

6.1 Demonstration of compliance involves the submission by the generator to NGET of data and the results of simulations studies, review by NGET of these documents to evaluate compliance and the testing of the plant to confirm compliance. The proposed CC.5 describes which of these is required prior to issue of each of the operational notifications. Data submission is required at all stages. Plant testing is required prior to the issue of FONs . Simulation studies are required prior to the issue of an ION.

6.2 It is proposed that a consistent format is used for the submission of data relating to compliance. This format will be defined by the User Data File Structure (the structure is shown in DRC Schedule 18). This structure is already used and is

currently referred to as the User Data Library. The use of this structure will clarify the data that is required and make it easier to determine for the generator and NGET whether required data has been submitted.

6.3 A new appendix to the Connection Conditions, appendix 8, details the simulation studies required and the results that should be submitted to NGET. Amongst others, simulation studies are required to validate both governor models that are submitted under the existing Grid Code requirements and governor performance under existing load rejection requirements. The group agreed that models for some technologies, particularly those currently being developed, are currently more complex than is needed and are expensive to develop. In recognition of this, the proposals do not require the submission of studies that validate these models until 2012, by which time more appropriate models are likely to be available.

6.4 New appendices have also been added detailing the plant tests that should be carried out in demonstrating compliance. These are appendix 13 for Synchronous Plant and appendix 14 for Power Park Modules.

6.5 The studies and tests described are based on NGET's experience of assessing compliance and in NGET's view are the most appropriate means of demonstrating compliance. However, to ensure that the most effective and efficient methods are used, the proposals allow for the generator and NGET to agree alternate methods of demonstrating compliance.

6.6 Power Park Modules are likely to employ a large number of identical wind turbines and generators are likely to use the same turbine types in a number of Power Park Modules. The group agreed that there would be benefit in developing a mechanism where a turbine needs only to be tested once, its recorded and documented performance being accepted in place of tests on subsequent turbines of the same type. These types of tests are typically undertaken and recorded by specialist test houses in Europe. The tests for the GB Grid Code are often combined with equivalent tests for Grid Codes from other countries, in order to minimise the total cost for the manufacturers.

6.7 The process for recording and referencing such data is described in CC.4.6. The data record will be called a "Manufacturer's Data and Performance Report". NGET will publish on its website a list of turbine types for which a report has been submitted that can be referenced by a generator.

6.8 The Manufacturer's Data and Performance Report will record the turbine's performance and will not indicate compliance or otherwise with the Grid Code. Grid Code compliance is based on the Power Park Module and is dependent on the whole module network and control systems as well as the turbines. Consequently the performance of the turbines in isolation cannot be extrapolated to indicate performance of the module.

6.9 The existing Grid Code requires developers to provide various models as part of building a new power station. The compliance process details how these models are verified and validated and as such defines the requirements for studies to be provided by the developer. A couple of the proposed studies have been seen as particularly onerous. These are the studies for active power performance during

islanding (high frequency island) and also verification of frequency controller models (needed by NGET for defense studies covering more severe system conditions than those covered by SQSS standards). In response to comments from one developer concerning how the models are demonstrated to be fit for purpose through studies, the explicit study requirements have been restricted to new plant connecting from 2012. The models themselves are already part of existing GC requirements. The delay to 2012 is intended to give time for developers and their suppliers to prepare for this. This complement the addition of a statement allowing the developer to propose alternative fit for purpose studies.

6.10 In response to continued concern from one developer on the difficulty in producing the verified frequency response study, it is proposed that NGET works closely with developers with the practicality of such studies, to ensure that only the essential high level model is included, avoiding unnecessarily detailed models which would be of little value and could incur significant cost.

6.11 The fault ride through study for synchronous plant previously covered in the Guidance Document for Synchronous Generators has been removed. This recognizes that NGET is better placed to do this study, in light of NGET specifying the main excitation system performance aspects relevant to this as well as having access to the system model required to study interactions for synchronous plant.

6.12 In the context of the studies to demonstrate the choice of parameters for Power System Stabilisers (covered in CC.A.8.2) one developer considers that the two studies specified (Bode Diagram and Eigenvalue) should be seen as alternatives whereas NGET considers these complementary and both required to manage system safety during commissioning.

6.13 Concern has been expressed by one developer regarding the staged testing requirements for Power Parks. The PP staged tests have been substantially reduced. This ensures that only the basic requirements for system stability (voltage and frequency) during the construction phase remain, allowing the gradual use of turbines as they each are completed. This now entails a simple voltage control test which can be undertaken once the first turbine is installed (the 20% test) and similarly a simple frequency controller test (Limited Frequency Sensitive Mode only) which can be undertaken once half the installation is completed (the 70% test, so called because it has to be completed before more than 70% can be connected). Full detailed performance tests are undertaken after the completion of the construction of the PP.

6.14 Experience from the existing compliance process based on the Guidance Notes for Power Park Developers concerning transient voltage control has shown the settling time for the voltage following an onload step change of 2 seconds to be inadequate. The settling time has been changed to 5 second to reflect the time steady state is expected to be achieved following a disturbance.

7.0 User self certification of compliance

7.1 At regular intervals, at least prior to each change of operational status, the generator, or DNO in some cases of a LEEMPS (see paragraphs 5.7 and 5.8),

will be required to inform NGET of its compliance status. This will be in the form of a User Self Certification of Compliance that will state that the generator complies with the Grid Code and lists any exceptions to this, such exceptions being termed Unresolved Issues. A generator with a FON will have no Unresolved Issues listed on the User Self Certification of Compliance.

8.0 Grid Code OC5

8.1 OC5 covers the identification and resolution of technical failures of plant in service. It includes provisions for plant testing. It is proposed that OC5 is modified so that any testing under this code is only undertaken to establish whether operational plant is compliant with particular Grid Code requirements when there is uncertainty, that is the generator and NGET are not both certain that the plant is either compliant or non-compliant. If a non-compliance is agreed, testing to establish that remedial work has made the plant compliant will be undertaken in line with the tests detailed in the proposed appendix 13 / 14. The proposals modify OC5 to reflect this.

8.2 OC5 also covers monitoring of operational plant. The proposals do not make any changes in relation to monitoring.

9.0 NGET's Guidance Notes

9.1 Following completion of this process to extend the Grid Code to include details of the compliance process, the two Guidance Notes[1] issued by NGET and made available to the industry on its web site will be withdrawn.

9.2 To provide information and guidance to manufacturers, who themselves are not subject to compliance with the Grid Code; NGET is considering issuing a suitable guidance document. This document will in particular focus on advice to the manufacturers for their preparation of the Manufacturer's Data and Performance Reports. Consideration will also be given to include in this document an introduction to the compliance process, e.g. such as that contained in sections 4 to 8 of this document.

10.0 Recommendations of the working group

The Grid Code Review Panel is asked to consider the drafting proposed by the Compliance Working Group and agree that NGET should proceed with a formal consultation. NGET agrees with the recommendations of the Compliance Working Group.

[1] http://www.nationalgrid.com/NR/rdonlyres/6C036707-27A4-4C43-AD8A-777487AAAFFF/28685/GuidanceNotesforPowerParkDevelopersIssue2September.pdf
http://www.nationalgrid.com/NR/rdonlyres/B4DF2400-96FD-40E5-AF44-8DB88AADA5DF/28686/GuidanceNotesforSynchronousGeneratorsIssue11Septem.pdf

11.0 Impact on Grid Code

11.1 The proposed changes require amendments to the following Grid Code sections:

i. Glossary and Definitions
ii. Planning Code
iii. Connections Code
iv. Operating Code
v. Data Registration Code

11.2 The associated legal text for the Working Group recommendations is outlined in Appendix 2 and Appendix 3, which relates to offshore generators.

12.0 Impact on Industry Documents

Impact on Core industry documents

12.1 The principles of the proposals in respect of LEEMPS require changes to be made to the CUSC, the Distribution Code and the DCUSA. These are being progressed in parallel to the Grid Code proposals. It will be necessary to ensure that the proposals to modify all affected codes are implemented at the same time. The Grid Code proposals may need modification in light of any changes that are made to proposals for modifications to other documents when they are subjected to consultation. For indicative purposes only, Appendix 4 sets out a possible timeline for progressing drafting amendments to the CUSC, Grid Code, Distribution Code and DCUSA.

Impact on other Industry Documents

12.2 None.

13.0 Impact on GB Transmission System

13.1 The Working Groups' preferred solution will have no material impact on the GB Transmission System.

14.0 Impact on Grid Code Users

14.1 The Compliance Working Groups' preferred solution will provide a high level of transparency within the Grid Code of the requirements associated with the compliance assessment process.

15.0 Assessment against Grid Code objectives

15.1 The proposed changes outlined in the Working Group Report would better facilitate Grid Code Objectives:

to facilitate competition in the generation and supply of electricity

by ensuring that the compliance assessment process to be used by NGET is visible to all generators and manufactures, and by ensuring that the process applied is consistent for all.

16.0 Environmental impact

16.1 The proposed changes are not expected to have any material impact on CO_2 and other green house gas emissions.

Appendix 1 – WORKING GROUP TERMS OF REFERENCE
Grid Code Compliance Working Group

Terms of Reference

Objective
At September 2007 GCRP it was agreed to establish a Grid Code Working Group which would be tasked with the review and recommendation of the codification of the compliance process and technical performance obligations (currently specified in the Compliance Guidance Notes).

Scope of Work
The group will address the following issues, as agreed by the GCRP**:**

(a) Technical Performance
The Working Group to review, identify and resolve any disparity between the Grid Code and Compliance Guidance Notes regarding technical performance obligations.

(b) Compliance Process
The Working Group will consider and make applicable recommendations regarding the codification of the compliance process (commissioning and lifetime phase) for directly connected and Large Power Stations into the Grid Code.

(c) OC5 Review
The Working Group will consider the applicability of the current OC5 provisions in light of the possible codification of the compliance process.

(d) Review of LEEMPS
The Working Group will re-evaluate the existing Licence Exempt Embedded Medium Power Stations provisions with particular reference to the respective responsibilities of Users and NGET and identify applicable recommendations.

Deliverables
National Grid will produce:

a GCRP paper recommending a way forward on the above issues, reflective of the group discussions and identification of consequential changes which may be required to other industry codes
draft legal text of any proposed Grid Code changes

Approach
Given the remit of the Working Group which is definable by distinct work areas, it is recommended that the findings are represented to the GCRP via the individual workstreams:

1. Technical Performance
A separate Working Group Report will be presented to the GCRP and an individual Consultation Report will be issued.

2. Compliance Process and Review of OC5
A separate Working Group Report will be presented to the GCRP and an individual Consultation Report will be issued. Depending on the interactivity between the compliance process and review of OC5, it may be appropriate to split the proposals into separate Working Group/Consultation Reports.

Timescales
The Working Group will aim to report back its recommendations from all workstreams by the February 2009 GCRP meeting. The GCRP will receive regular updates on the progress of the

Working Group. It is anticipated that the Technical Performance recommendations will be presented to the May 2008 GCRP.

Membership
The membership of the working group will be drawn from the GCRP or their nominated representatives, the Relevant Transmission Licensees, and Ofgem.

Compliance Working Group Members
Members of the GCRP Working group will be as follows:

Chair		*Secretary*	
Mark Perry	National Grid	Richard Dunn	National Grid

National Grid Representatives
Helge Urdal
Steve Hoar
Kathryn Sorrell

Industry Representatives

Chris Berry	Scottish Power Networks
Claire Maxim	E.ON
John Norbury	RWE Trading
Mick Chowns	RWE Trading
Damien McCool	Scottish Power Renewables
Mike Kay	Electricity North West
John Morris	British Energy

Authority Observer

Bridget Morgan	Ofgem

PROPOSED CHANGES TO THE GRID CODE TO INTRODUCE THE COMPLIANCE PROCESS
BY THE COMPLIANCE WORKING GROUP

JANUARY 2009

NOTE re CHANGE MARKING: *Deletions from current (as at 27 January 2009) Grid Code text are shown struck through in red, additions are underlined and shown in blue, where the text has been moved, the change is shown (as either struck through or underlined) in green.*

GLOSSARY & DEFINITIONS

New defined terms for inclusion in the G&D:

Compliance Statement	A statement to be completed by the relevant **User** confirming compliance with each of the relevant **Grid Code** provisions, and the supporting evidence in respect of such compliance, of its: **Generating Unit(s),** **CCGT Module(s),** **Power Park Module(s)** or **DC Converter(s)** in the form provided by **NGET** to the relevant **User**.
DCUSA	The Distribution Connection and Use of System Agreement approved by the **Authority** and required to be maintained in force by each **Electricity Distribution Licence** holder.
Energisation Operational Notification (EON)	A notification (in respect of **Plant** and **Apparatus** which is directly connected to the **GB Transmission System**) by **NGET** to a **User** confirming that the **User** can in accordance with the **Bilateral Agreement** and/or **Construction Agreement**, energise such **User's Plant** and **Apparatus** specified in such notification.
Final Operational Notification (FON)	A notification by **NGET** to a **Generator** or **DC Converter Station** owner (or where a **Network Operator CC Confirmation Notice** applies, to the relevant **Network Operator**) confirming that the **User** has demonstrated compliance: (1) with the **Grid Code**, (or where they apply, that relevant derogations have been granted), and (2) where applicable, with Appendices F1 to F5 (or Appendix E in the case of **LEEMPS/DCCS**) of the **Bilateral Agreement,** in each case in respect of the **Plant** and

	Apparatus specified in such notification.
Interim Operational Notification (ION)	A notification by **NGET** to a **Generator** or **DC Converter Station** owner (or where a **Network Operator CC Confirmation Notice** applies, to the relevant **Network Operator)** acknowledging that the **User** has demonstrated compliance, except for the **Unresolved Issues**: (1) with the **Grid Code,** and (2) where applicable, with Appendices F1 to F5 (or Appendix E in the case of **LEEMPS/DCCS)** of the **Bilateral Agreement,** in each case in respect of the **Plant** and **Apparatus** specified in such notification.
LEEMPS/DCCS	Each of, as the context so requires, an **Embedded Medium Power Station** not subject to a **Bilateral Agreement** or an **Embedded Medium DC Converter Station** not subject to a **Bilateral Agreement.**
LEEMPS/DCCS CC Compliance Assessment	The compliance assessment to be undertaken by **NGET** or the **Network Operator** in respect of **LEEMPS/DCCS** in accordance with CC.3.3.
Limited Operational Notification (LON)	A notification by **NGET** to a **Generator** or **DC Converter Station** owner (or in the case of **LEEMPS/DCCS,** to the relevant **Network Operator)** stating that the **User's Plant** and/or **Apparatus** specified in such notification may be, or is, unable to comply: (1) with the provisions of the **Grid Code** specified in the notice, and (2) where applicable, with Appendices F1 to F5 (or Appendix E in the case of **LEEMPS/DCCS)** of the **Bilateral Agreement** , and specifying the **Unresolved Issues**.
Manufacturer's Data & Performance Report	A report submitted by a manufacturer relating to a specific version of a **Power Park Unit** demonstrating the performance characteristics of such **Power Park Unit** in respect of which **NGET** has evaluated its relevance for the purposes of CC.4.6.
Operational Notifications	Any **Energisation Operational Notification**, **Interim Operational Notification**, **Final Operational Notification** or **Limited Operational Notification** issued by **NGET.**
Network Operator CC Compliance Notice	Has the meaning set out in CC.3.3.5(d).

Notification of User's Intention to Synchronise	A notification by a **Generator** or **DC Converter Station** owner to **NGET** informing **NGET** of the date upon which a **Generating Unit(s), CCGT Module(s), Power Park Module(s)** or **DC Converter(s)** will be ready to be **Synchronised** to the **Total System**.
Unresolved Issues	Any relevant **Grid Code** provisions or **Bilateral Agreement** requirements identified by **NGET** with which the relevant **User** has not demonstrated compliance to **NGET's** satisfaction at the date of issue of the **Interim Operational Notification** and/or **Limited Operational Notification** and which are detailed in such **Interim Operational Notification** and/or **Limited Operational Notification**.
User Data File Structure	A file structure (an example is given at DRC 18) which will be specified by **NGET** which a **Generator** or **DC Converter Station** owner must use for the purposes of CC.5 to submit **DRC** data Schedules and information demonstrating compliance with the **Grid Code** and, where applicable, with the **CUSC Contract(s)**.
User Self Certification of Compliance	A certificate, in the form attached at CC.A.12: (1) completed by a **Generator** or **DC Converter Station** owner to which the **Compliance Statement** is attached; or, (2) in the case of **LEEMPS/DCCS** (where CC.3.3.4 (b) (NGET Option) applies) completed by the **LEEMPS/DCCS** to which the **Compliance Statement** is attached; or (3) in the case of **LEEMPS/DCCS** (where CC.3.3.4 (a) (Network Operator Option) applies) completed by the **Network Operator** to which the **Compliance Statement** is attached and to which the **LEEMPS/DCCS** own **User Self Certification of Compliance** is attached, which confirms that such **Plant** and **Apparatus** complies with the relevant **Grid Code** provisions and where appropriate, with the **CUSC Contract(s)**, as identified in the **Compliance Statement** and, if appropriate, identifies any **Unresolved Issues** and/or any exceptions to such compliance and details the derogation(s) granted in respect of such exceptions.

CHANGES TO PLANNING CODE:

1. PC.A.2.5.5.7 shall be amended as follows:

PC.A.2.5.5.7 Where a **Manufacturer's Data & Peformance Report** exists in respect of the model of the **Power Park Unit,** the **User** may opt to reference the **Manufacturer's Data & Performance Report** as an alternative to the provision of data in accordance with this PC.A.2.5.5.7. For the avoidance of doubt, all other data provision pursuant to the **Grid Code** shall still be provided including a Single Line Diagram and those data pertaining thereto.

For each **Power Park Module** and each type of **Power Park Unit (**~~eg~~e.g. Doubly Fed Induction Generator)**,** including any **Auxiliaries**, positive, negative and zero sequence root mean square current values are to be provided of the contribution to the short circuit current flowing at

(i) the **Power Park Unit** terminals, or the **Common Collection Busbar** if an equivalent **Single Line Diagram** and associated data as described in PC.A.2.2.2 is provided, and
(ii) the **Grid Entry Point**, or **User System Entry Point** if **Embedded**

for the following solid faults at the **Grid Entry Point**, or **User System Entry Point** if **Embedded**:

- ~~(i)~~ a symmetrical three phase short circuit
- ~~(ii)~~ a single phase to earth short circuit
- ~~(iii)~~ a phase to phase short circuit
- ~~(iv)~~ a two phase to earth short circuit

For a **Power Park Module** in which one or more of the **Power Park Units** utilise a protective control such as a crowbar circuit, the data should indicate whether the protective control will act in each of the above cases and the effects of its action shall be included in the data. For any case in which the protective control will act, the data for the fault shall also be submitted for the limiting case in which the protective circuit will not act, which may involve the application of a non-solid fault, and the positive, negative and zero sequence retained voltages at

(i) the **Power Park Unit** terminals, or the **Common Collection Busbar** if an equivalent **Single Line Diagram** and associated data is provided and
(ii) the **Grid Entry Point**, or **User System Entry Point** if **Embedded**

in this limiting case shall be provided.

For each fault for which data is submitted, the data items listed under the following parts of PC.A.2.5.6(a) shall be provided:-

(iv), (vii), (viii), (ix), (x);

In addition, if an equivalent **Single Line Diagram** has been provided the data items listed under the following parts of PC.A.2.5.6(a) shall be provided:-

(xi), (xii), (xiii);

In addition, for a **Power Park Module** in which one or more of the **Power Park Units** utilise a protective control such as a crowbar circuit:-

the data items listed under the following parts of P.C.A.2.5.6(a) shall be provided:-

(xiv), (xv);

All of the above data items shall be provided in accordance with the detailed provisions of PC.A.2.5.6(c), (d), (f).

Should actual data in respect of fault infeeds be unavailable at the time of the application for a **CUSC Contract** or **Embedded Development Agreement**, a limited subset of the data, representing the maximum fault infeed that may result from all of the plant types being considered, shall be submitted. This data will, as a minimum, represent the root mean square of the positive, negative and zero sequence components of the fault current for both single phase and three phase solid faults at the **Grid Entry Point** (or **User System Entry Point** if **Embedded**) at the time of fault application and 50ms following fault application. Actual data in respect of fault infeeds shall be submitted to **NGET** as soon as it is available, in line with PC.A.1.2

……

2. PC.A.5.4.2 shall be amended as follows:

PC.A.5.4.2 The following **Power Park Unit, Power Park Module** and **Power Station** data should be supplied in the case of a **Power Park Module** not connected to the **Total System** by a **DC Converter**:

Where a **Manufacturer's Data & Performance Report** exists in respect of the model of the **Power Park Unit,** the **User** may subject to **NGET's** agreement, opt to reference the **Manufacturer's Data & Performance Report** as an alternative to the provision of data in accordance with PC.A.5.4.2 except for:

(1) the section marked thus # at sub paragraph (b); and

(2) all of the harmonic and flicker parameters required under sub paragraph (h); and

(3) all of the site specific model parameters relating to the voltage or frequency control systems required under sub paragraphs (d) and (e).

which must be provided by the **User** in addition to the **Manufacturer's Data & Performance Report** reference.

(a) **Power Park Unit** model

A mathematical model of each type of **Power Park Unit** capable of representing its transient and dynamic behaviour under both small and large disturbance conditions. The model shall include non-linear effects and represent all equipment relevant to the dynamic performance of the **Power Park Unit** as agreed with **NGET**. The model shall be suitable for the study of balanced, root mean square, positive phase sequence time -domain behaviour, excluding the effects of electromagnetic transients, harmonic and sub-harmonic frequencies.

The model shall accurately represent the overall performance of the **Power Park Unit** over its entire operating range including that which is inherent to the **Power Park Unit** and that which is achieved by use of supplementary control systems providing either continuous or stepwise control. Model resolution should be sufficient to accurately represent **Power Park Unit** behaviour both in response to operation of transmission system protection and in the context of longer-term simulations.

The overall structure of the model shall include:

(i) any supplementary control signal modules not covered by (c), (d) and (e) below.
(ii) any blocking, deblocking and protective trip features that are part of the **Power Park Unit** (e.g. "crowbar").
(iii) any other information required to model the **Power Park Unit** behaviour to meet the model functional requirement described above.

The model shall be submitted in the form of a transfer function block diagram and may be accompanied by dynamic and algebraic equations.
This model shall display all the transfer functions and their parameter values, any non wind-up logic, signal limits and non-linearities.

The submitted **Power Park Unit** model and the supplementary control signal module models covered by (c), (d) and (e) below shall have been validated and this shall be confirmed by the **Generator**. The validation shall be based on comparing the submitted model simulation results against measured test results. Validation evidence shall also be submitted and this shall include the simulation and

measured test results. The latter shall include appropriate short-circuit tests. In the case of an **Embedded Medium Power Station** not subject to a **Bilateral Agreement** the **Network Operator** will provide **NGET** with the validation evidence if requested by **NGET**. The validation of the supplementary control signal module models covered by (c), (d) and (e) below applies only to a **Power Park Module** with a **Completion date** after 1 January 2009.

(b) **Power Park Unit** parameters

* Rated MVA
* **Rated MW**
* Rated terminal voltage
* Average site air density (kg/m^3), maximum site air density (kg/m^3) and minimum site air density (kg/m^3) for the year
  Year for which the air density is submitted
  Number of pole pairs
  Blade swept area (m^2)
  Gear box ratio

Mechanical drive train

For each **Power Park Unit**, details of the parameters of the drive train represented as an equivalent two mass model should be provided. This model should accurately represent the behaviour of the complete drive train for the purposes of power system analysis studies and should include the following data items:-

Equivalent inertia constant (MWsec/MVA) of the first mass (e.g. wind turbine rotor and blades) at minimum, synchronous and rated speeds
Equivalent inertia constant (MWsec/MVA) of the second mass (e.g. generator rotor) at minimum, synchronous and rated speeds
Equivalent shaft stiffness between the two masses (Nm/electrical radian)

Additionally, for **Power Park Units** that are induction generators (e.g. squirrel cage, doubly-fed) driven by wind turbines:

* Stator resistance
* Stator reactance
* Magnetising reactance.
* Rotor resistance.(at starting)
* Rotor resistance.(at rated running)
* Rotor reactance (at starting)
* Rotor reactance (at rated running)

Additionally for doubly-fed induction generators only:

The generator rotor speed range (minimum and maximum speeds in RPM)
The optimum generator rotor speed versus wind speed submitted in tabular format
Power converter rating (MVA)

The rotor power coefficient (C_p) versus tip speed ratio (λ) curves for a range of blade angles (where applicable) together with the corresponding values submitted in tabular format. The tip speed ratio (λ) is defined as $\Omega R/U$ where Ω is the angular velocity of the rotor, R is the radius of the wind turbine rotor and U is the wind speed.

The electrical power output versus generator rotor speed for a range of wind speeds over the entire operating range of the **Power Park Unit**, together with the corresponding values submitted in tabular format.

The blade angle versus wind speed curve together with the corresponding values submitted in tabular format.

The electrical power output versus wind speed over the entire operating range of the **Power Park Unit**, together with the corresponding values submitted in tabular format.
Transfer function block diagram, including parameters and description of the operation of the power electronic converter and fault ride through capability (where applicable).

For a **Power Park Unit** consisting of a synchronous machine in combination with a back to back **DC Converter,** or for a **Power Park Unit** not driven by a wind turbine, the data to be supplied shall be agreed with **NGET** in accordance with PC.A.7.

(c) Torque / speed and blade angle control systems and parameters

For the **Power Park Unit**, details of the torque / speed controller and blade angle controller in the case of a wind turbine and power limitation functions (where applicable) described in block diagram form showing transfer functions and parameters of individual elements.

(d) Voltage/**Reactive Power**/**Power Factor** control system parameters

For the **Power Park Unit** and **Power Park Module** details of voltage/**Reactive Power**/**Power Factor** controller (and **PSS** if fitted) described in block diagram form showing transfer functions and parameters of individual elements.

(e) **Frequency** control system parameters

For the **Power Park Unit** and **Power Park Module** details of the **Frequency** controller described in block diagram form showing transfer functions and parameters of individual elements.

(f) Protection

Details of settings for the following protection relays (to include): Under **Frequency**, over **Frequency**, under voltage, over voltage, rotor over current, stator over current, high wind speed shut down level.

(g) Complete **Power Park Unit** model, parameters and controls

An alternative to PC.A.5.4.2 (a), (b), (c), (d), (e) and (f), is the submission of a single complete model that consists of the full information required under PC.A.5.4.2 (a), (b), (c), (d), (e) and (f) provided that all the information required under PC.A.5.4.2 (a), (b), (c), (d), (e) and (f) individually is clearly identifiable.

(h) Harmonic and flicker parameters

When connecting a **Power Park Module**, it is necessary for **NGET** to evaluate the production of flicker and harmonics on **NGET** and **User's Systems**. At **NGET's** reasonable request, the **User** (a **Network Operator** in the case of an **Embedded Power Park Module** not subject to a **Bilateral Agreement**) is required to submit the following data (as defined in IEC 61400-21 (2001)) for each **Power Park Unit** expressed at the **Common Collector Busbar**:-

Flicker coefficient for continuous operation.
Flicker step factor.
Number of switching operations in a 10 minute window.
Number of switching operations in a 2 hour window.
Voltage change factor.
Current Injection at each harmonic for each **Power Park Unit** and for each **Power Park Module**

* Data items marked with an asterisk are already requested under part 1, PC.A.3.3.1, to facilitate an early assessment by **NGET** as to whether detailed stability studies will be required before an offer of

terms for a **CUSC Contract** can be made. Such data items have been repeated here merely for completeness and need not, of course, be resubmitted unless their values, known or estimated, have changed.

CONNECTION ~~CONDITIONS~~CONDITION CHANGES:

1 Amend CC.1 to CC.5 as follows:

CC.1 INTRODUCTION

CC.1.1 The **Connection Conditions** (~~"~~"**CC**~~"~~") specify both~~;~~

(a) the minimum technical, design and operational criteria which must be complied with by (i) any **User** connected to or seeking connection with the **GB Transmission System** or (ii) **Generators** (other than in respect of **Small Power Stations**) or **DC Converter Station** owners connected to or seeking connection to a **User~~'~~'s System** which is located in **Great Britain**~~,~~; and

(b) the minimum technical, design and operational criteria with which **NGET** will comply in relation to the part of the **GB Transmission System** at the **Connection Site** with **Users**.

CC.1.2 The **CC** also specifies the process (**Interim Operational Notification** and **Final Operational Notification**) which must be followed by **NGET** and any **Generator** or **DC Converter Station** owner to demonstrate its compliance with the **Grid Code** in relation to its **Plant** and **Apparatus**. This process shall be followed prior to and during the course of the relevant **Plant** and **Apparatus** being energised and **Synchronised**.

CC.1.3 The **CC** also specifies the process (**Limited Operational Notification**) which must be followed by **NGET** and each **Generator** and **DC Converter Station** owner where any of its **Plant** and/or **Apparatus** becomes unable to comply with relevant provisions of the **Grid Code**, and where applicable with Appendices F1 to F5 of the **Bilateral Agreement**, or in the case of a **LEEMPS/DCCS**, Appendix E to the relevant **Network Operator's Bilateral Agreement**. This process applies to such **Plant** and/or **Apparatus** after the **Plant** and/or **Apparatus** has become **Operational** and until **Disconnected** from the **Total System**.

CC.2 OBJECTIVE

CC.2.1 The objective of the **CC** is to ensure that by specifying minimum technical, design and operational criteria the basic rules for connection to the **GB Transmission System** and (for certain **Users**) to a **User~~'~~'s System** are similar for all **Users** of an equivalent category and will enable **NGET** to comply with its statutory and **Transmission Licence** obligations.

CC.3 SCOPE

CC.3.1 The **CC** applies to **NGET** and to **Users**, which in the **CC** means:

(a) **Generators** (other than those which only have **Embedded Small Power Stations**)

(b) **Network Operators**;

(c) **Non-Embedded Customers;**

(d) **DC Converter Station** owners; and

(e) **BM Participants** and **Externally Interconnected System Operators** in respect of CC.6.5 only**.**

CC.3.2 The above categories of **User** will become bound by the **CC** prior to them generating, distributing, supplying or consuming, as the case may be, and references to the various categories should, therefore, be taken as referring to them in that prospective role as well as to **Users** actually connected.

CC.3.3 **LEEMPS/DCCS** Provisions

The following provisions apply to **LEEMPS/DCCS.**

CC.3.3.1 ***Network Operator General Obligation:*** The obligations within the **CC** that are expressed to be applicable to **Generators** ~~in respect of **Embedded Medium Power Stations** not subject to a **Bilateral Agreement** and~~or **DC Converter Station** ~~Owners~~owners in respect of ~~**Embedded DC Converter Stations** not subject to a **Bilateral Agreement**~~**LEEMPS/DCCS** (where the obligations are in each case listed or described in this CC.~~3.4~~3.3) shall be read and construed as obligations that the **Network Operator** within whose **System** any such ~~**Medium Power Station** or **DC Converter Station**~~**LEEMPS/DCCS** is **Embedded** must ensure are performed and discharged by the **Generator** or the **DC Converter Station** owner. Each **Network Operator** shall ensure that in respect of any **LEEMPS/DCCS Embedded** in its **System** the obligations on the relevant **Generators** or **DC Converter Station** owners in respect of such **LEEMPS/DCCS** contained in the **Distribution Code,** which reflect the obligations in these **Connection Conditions**, are performed and discharged by the relevant **Generator** or the **DC Converter Station** owner as applicable.

CC.~~3.4~~ 3.3.2 ***Information and Technical Requirements:*** The **Network Operator** within whose **System** a ~~**Medium Power Station** not subject to a **Bilateral Agreement** is **Embedded** or a **DC Converter Station** not subject to a **Bilateral Agreement**~~**LEEMPS/DCCS** is **Embedded** must ensure that the following obligations in the **CC** are performed and discharged by the **Generator** ~~in respect of each such **Embedded**~~

~~Medium Power Station~~ or the **DC Converter Station** owner ~~in~~, as the case ~~of an **Embedded DC Converter Station**~~may be, in respect of each such **LEEMPS/DCCS**:

CC.5.1
CC.5.2.2
~~CC.5.3~~
CC.6.1.3
CC.6.1.5 (b)
CC.6.3.2, CC.6.3.3, CC.6.3.4, CC.6.3.6, CC.6.3.7, CC.6.3.8, CC.6.3.9, CC.6.3.10, CC.6.3.12, CC.6.3.13, CC.6.3.15, CC.6.3.16
CC.6.4.4
~~CC.6.5.6 (where required by CC.6.4.4)~~

In respect of CC.6.2.2.2, CC.6.2.2.3, CC.6.2.2.5, CC.6.1.5(a), CC.6.1.5(b) and CC.6.3.11 equivalent provisions as co-ordinated and agreed with the **Network Operator** and **Generator** or **DC Converter Station** owner may be required. Details of any such requirements will be notified to the **Network Operator** in accordance with CC.~~3.5.~~3.3.3.

CC.~~3.5~~ ~~In the case of **Embedded Medium Power Stations** not subject to a **Bilateral Agreement** and **Embedded DC Converter Stations** not subject to a **Bilateral Agreement**~~3.3.3 ***Further Technical Requirements:*** In the case of **LEEMPS/DCCS** the requirements in:

CC.6.1.6
CC.6.3.8
CC.6.3.12
CC.6.3.15
CC.6.3.16

that would otherwise have been specified in a **Bilateral Agreement** will be notified to the relevant **Network Operator** in writing in accordance with the provisions of the **CUSC** and the **Network Operator** must ensure such requirements are performed and discharged by the **Generator** or the **DC Converter Station** owner.

CC.3.3.4 ***LEEMPS/DCCS Compliance Demonstration Options:*** Compliance (prior to and during the commissioning of **LEEMPS/DCCS)** with the requirements of the **CC**, may be demonstrated in one of two ways in respect of **LEEMPS/DCCS**:

(a) ***Network Operator Option:*** where the **Network Operator** has that role in accordance with the provisions of CC.3.3.5 below, the **Network Operator** shall apply its processes relating to compliance assessment, with the **Generator** or the **DC Converter Station** owner providing a **User Self Certification of Compliance** to the **Network Operator** in relation to compliance, which the **Network Operator** can then pass on to **NGET** attached to its own **User Self Certification of Compliance** addressed to **NGET**;

(b) ***NGET Option***: where **NGET** has that role in accordance with the provisions of CC.3.3.5 below, it will apply its processes relating to compliance assessment, with the **Generator** or the **DC Converter Station** owner providing a **User Self Certification of Compliance** direct to **NGET** in relation to compliance.

CC.3.3.5 **LEEMPS/DCCS CC Compliance Assessment**

(a) ***NGET Role:*** **NGET** shall undertake the **LEEMPS/DCCS CC Compliance Assessment** in place of the **Network Operator** from *[the date of the implementation of the Grid Code change]* in respect of all **LEEMPS/DCCS** connected, or to be connected, to each **Network Operator's User System.**

(b) ***Network Operator Role if Prior Notified Plant:*** Except where **NGET**, the relevant **Network Operator** and the relevant **Generator** have all agreed otherwise in writing, this role will not apply to those **LEEMPS/DCCS** which have already been notified to **NGET** before that date under the provisions of the **CUSC** that relate to the **Statement of Works**.

(c) ***Network Operator Role if a Network Operator CC Compliance Notice Issued:*** In addition this role will not apply in respect of **LEEMPS/DCCCS** where a **Network Operator** has served a **Network Operator CC Compliance Notice**, as provided below. In such case, the **Network Operator** shall notify **NGET** when its compliance assessment process in respect of the **LEEMPS/DCCS** has been completed.

(d) ***Network Operator CC Compliance Notice:*** A **Network Operator** may, by written notification to **NGET** (a "**Network Operator CC Compliance Notice**") elect that, in respect of all **LEEMPS/DCCS** connected to its **User System,** the **Network Operator** shall undertake the **Grid Code CC Compliance Assessment** in place of **NGET** from the date specified in the **Network Operator CC Compliance Notice.**

(e) ***Notice Requirements:*** A **Network Operator CC Compliance Notice** may only:

(i) be served to take effect no earlier than 12 months after its date of receipt by **NGET** (or such shorter period as **NGET,** the relevant **Network Operator** and the relevant **Generator** have all agreed to in writing);

(ii) be in respect of all **LEEMPS/DCCS** to be connected to its **User System**, which will be notified to **NGET** under the provisions of the **CUSC** that relate to the **Statement of Works** after the expiry of the 12 months' (or such shorter period) notice period referred to above;

(f) ***Other Compliance Requirements:*** The **CUSC Contract(s)**, the **DCUSA** and the **Embedded Development Agreement** for the connection and the **Distribution Code** also contain relevant provisions dealing with **NGET** undertaking the **Grid Code CC Compliance Assessment** in place of the **Network Operator**.

CC.3.3.6 **Responsibility for Ongoing Compliance for LEEMPS/DCCS**

In respect of **LEEMPS/DCCS**, once the initial assessment of compliance has been completed irrespective of responsibility for establishing initial compliance for new **LEEMPS/DCCS**, the ongoing responsibility for monitoring and testing is with the **Network Operator** to which the **LEEMPS/DCCS** is connected.

The **Network Operator** will determine the process for managing the return to full compliance, an equivalent of the **LON** process operated by **NGET** (described in CC.4.5) for licensed generators.

Should a disagreement exist between the **Network Operator** and the **LEEMPS/DCCS** owner about the ongoing compliance of a **LEEMPS/DCCS** then it is the responsibility of the **Network Operator** to initiate investigative testing to resolve the issue. Management of **NGET**'s interests and concerns in this respect are set out in OC.5.8.

Where the **Network Operator** has not resolved any ongoing compliance issues in respect of **LEEMPS/DCCS** within 4 months of the **Network Operator** being aware of the issue, **NGET** will apply the **Limited Operational Notification** process as between **NGET** and the relevant **Network Operator**, and the provisions of CC.4 shall be read and construed accordingly.

CC.4 PROCEDURE AND CONNECTION PROCESS

CC.4.1 The **CUSC** ~~contains~~**Contract(s)** contain certain provisions relating to the procedure for connection to the **GB Transmission System** or, in the case of ~~**Embedded Power Stations** or **Embedded DC Converter Stations**~~**LEEMPS/DCCS**, becoming operational and ~~includes~~include provisions relating to certain conditions to be complied with by **Users** prior to and during the course of **NGET** notifying the **User** that it has the right to become operational.

Connection Process

CC.4.2 (a) ***Connection and Compliance:*** The provisions contained in CC.4.2 to CC.4.3 and CC.5:

(i) relate to the connection of **User's Plant** and **Apparatus** to the **GB Transmission System** or where **Embedded,** to a **User's System,** and

(ii) provide the process (shown diagrammatically at CC.A.9 – Process 1) for **Generator's** and **DC Converter Station** owners to demonstrate compliance with the **Grid Code** and with, where applicable, the **CUSC Contract(s)** prior to and during the course of such **Generator's** or **DC Converter Station** owner's **Plant** and **Apparatus** becoming operational.

(b) ***Compliance – User System:*** The initial assessment of compliance (as shown diagrammatically at CC.A.10 – Process 2) in the case of **LEEMPS/DCCS** connected to a **User System,** will be undertaken by **NGET** under the arrangement with the **Network Operator** referred to in CC.3.3, (except where the **Network Operator** has served a **Network Operator CC Compliance Notice** on **NGET**, in which case the **Network Operator** shall undertake that process to the extent that that notice applies).

CC.4.2.1 ***Operational Process:*** CC.4.2 to CC.4.4 contains details of the process to be followed in order for the **User's Plant** and **Apparatus** to become operational.

CC.4.2.2 ***Data Submission:*** CC.5 specifies the information and data which must be submitted by the **User** to **NGET** at specific stages in the process of becoming operational, including ahead of receiving **EON** (energisation CC.5.2), **ION** (synchronising interim CC.5.3) and **FON** (final CC.5.4).

CC.4.2.3 ***Tests:*** In addition CC.5.5 specifies the tests that must be performed and which must be demonstrated to **NGET's** satisfaction at specific times in the process of becoming operational.

CC.4.2.4 ***LON:*** The provisions contained in CC.4.5 relate to the **Limited Operational Notification** process (shown diagrammatically at CC.A.11 – Process 3) to be followed when a directly connected or licensed embedded **Generator** or **DC Converter Station** owner's **Plant** and/or **Apparatus** is unable to comply with any provisions of the **Grid Code** and where applicable with Appendices F1 to F5 (or Appendix E in the case of **LEEMPS/DCCS)** of the **Bilateral Agreement**.

CC.4.3 (a) ***Other Relevant Documents:*** Certain provisions relating to the connection and energisation of the **User's Plant** and **Apparatus** at the **Connection Site** and in certain cases of **Embedded Plant** and **Apparatus** are specified in the **CUSC** and/or **CUSC Contract(s).** For other **Embedded Plant** and **Apparatus** the **Distribution Code**, the **DCUSA** and the **Embedded Development Agreement** for the connection specify equivalent provisions. Further detail on this is set out in CC.5.1 below.

(b) ***CUSC Obligations and issue of Energisation Operational Notification:*** The obligations under the provisions of the **CUSC** and/or **CUSC Contract(s)** must have been completed to **NGET's** reasonable satisfaction and, in the case of a **Power Station** or a **DC Converter Station** directly connected to the

GB Transmission System, an **Energisation Operational Notification** must have been issued by **NGET** (unless NGET agree otherwise) prior to the remainder of this CC.4.3 being completed.

(c) ***Grid Code Obligations:*** This CC.4.3 details the requirements that apply to the **Generator** or **DC Converter Station** owner before and during the process of demonstrating compliance with the **Grid Code**. Such demonstration is dependent on submission by the **Generator** or **DC Converter Station** owner to **NGET** of the items identified under CC.5.3 and CC.5.4.

(d) ***New and Changed Plant:*** The provisions of CC.4.3, CC.4.4 and CC.5 shall apply in respect of both new **Power Stations** and new **DC Converter Stations** and (save where the **Limited Operational Notification** process has been initiated) following any notification by a **Generator** or a **DC Converter Station** owner under the **PC** of any change to its **Plant** and **Apparatus**. In the case of any changes to a **Generator's** or a **DC Converter Station** owner's **Plant** and/or **Apparatus**, **NGET** will determine whether or not all the requirements of CC.4.3, CC.4.4 and CC.5 are appropriate or whether more limited requirements are appropriate. **NGET** shall make such a determination based upon the nature of the change to **Plant** and/or **Apparatus** and/or **Modification** and acting in accordance with **Good Industry Practice**.

Interim Operational Notification

CC.4.3.1 ***Notification of User Intention to Synchronise:*** Not less than 28 days, or such shorter period as may be acceptable in **NGET's** reasonable opinion, prior to the **Generator** or **DC Converter Station** owner wishing to **Synchronise** its **Plant** and **Apparatus** for the first time the **Generator** or **DC Converter Station** owner will:

(i) notify **NGET** that the **Generating Unit(s)**, **CCGT Module(s)**, **Power Park Module(s)** or **DC Converter(s)** as applicable will be ready to be **Synchronised** to the **Total System** through the delivery to **NGET** of a **Notification of Users Intention to Synchronise**, and

(ii) submit to **NGET** the items referred to at CC.5.3.

CC.4.3.2 (a) ***Directly Connected***:

No **Generating Unit**, **CCGT Module**, **Power Park Module** or **DC Converter** shall be **Synchronised** to the **GB Transmission System** until the later of:

(i) the date specified by **NGET** in the **Interim Operational Notification** issued in respect of the **Generating Unit(s), CCGT Module(s), Power Park Module(s)** or **DC Converter(s)**;

(ii) in the case of **Synchronous Generating Unit(s)** only, written confirmation from **NGET** that the **Generating Unit** or **CCGT Module** as applicable, has performed the tests detailed at CC.4.3.3 to **NGET's** satisfaction; and

(b) ***Embedded (other than LEEMPS/DCCS):***

No **Generating Unit**, **CCGT Module**, **Power Park Module** or **DC Converter** which is **Embedded** (other than **LEEMPS/DCCS**) shall be **Synchronised** to a **User System**, until the later of:

(i) the date specified by **NGET** in the **Interim Operational Notification** issued in respect of the **Generating Unit(s), CCGT Module(s), Power Park Module(s)** or **DC Converter(s)**;

(ii) in the case of **Synchronous Generating Unit(s)** only the requirements of CC.4.3.3 have been completed to **NGET's** satisfaction;

(iii) receipt of a confirmation from the **Network Operator** in whose **System** the **Plant and Apparatus** is connected that it is acceptable to the **Network Operator** that the **Plant and Apparatus** be connected and **Synchronised**.

(c) ***Embedded LEEMPS/DCCS:***

Where CC.3.3.4(b) (NGET Option) applies:

No **LEEMPS/DCCS** shall be **Synchronised** to a **User System**, until the later of:

(i) receipt by **NGET** from the **LEEMPS/DCCS** of the **User Self Certification of Compliance**;

(ii) the date specified in an **Interim Operational Notification** from **NGET** to the **LEEMPS/DCCS** (with a copy to the **Network Operator**);

(iii) the date specified by the **Network Operator,** in whose **System** the **Plant** and **Apparatus** is connected, in the written confirmation to the **LEEMPS/DCCS** (with a copy being provided to **NGET**) that it is acceptable to the **Network Operator** that the **Plant** and **Apparatus** be connected and **Synchronised**;

(iv) in the case of **Synchronous Generating Unit(s)** where the requirements of CC.4.3.3 have been completed to **NGET's** satisfaction ; and

(v) receipt by **NGET** of the items identified under CC.5.2.2.

Where CC.3.3.4(a) (Network Operator Option) applies

No **LEEMPS/DCCS** shall be **Synchronised** to a **User System**, until the later of:

(vi) receipt by the **Network Operator** from the **LEEMPS/DCCS** of confirmation of its compliance;

(vii) receipt by **NGET** from the **Network Operator** of the **User Self Certification of Compliance** in respect of the **LEEMPS/DCCS** (with the **LEEMPS/DCCS'** own **User Self Certification of Compliance** attached);

(viii) the date specified by the **Network Operator,** in whose **System** the **Plant** and **Apparatus** is connected, in the written confirmation to the **LEEMPS/DCCS** (with a copy being provided to **NGET**) that it is acceptable to the **Network Operator** that the **Plant** and **Apparatus** be connected and **Synchronised**;

(ix) in the case of **Synchronous Generating Unit(s)** where the requirements of CC.4.3.3 have been completed to the **Network Operator's** satisfaction.

CC.4.3.3 ***Short Circuit Ratio and Step Response Steps:*** In the case of **Synchronous Generating Unit(s**) only, the **Generator** must complete the following tests to **NGET's** satisfaction (or to the **Network Operator's** satisfaction where **a Network Operator CC Compliance Notice** applies) to demonstrate compliance with the relevant provisions of the **CC**s prior to the **Generating Unit** being **Synchronised** to the **Total System**:

(a) those tests required to establish the open and short circuit saturation characteristics of the **Generating Unit** to enable assessment of the short circuit ratio in accordance with CC.6.3.2. Such tests may be carried out at a location other than the **Power Station** site; and

(b) open circuit step response tests (as detailed in Appendix CC.A.13.2 to demonstrate compliance with CC.A.6.2.4.1.

CC.4.3.4 ***NGET Assessment of Test Documentation:*** **NGET** shall assess the schedule of tests submitted by the **Generator** or **DC Converter Station** owner with the **Notification of Users Intention to Synchronise** under CC.4.3.1 and shall determine whether such schedule has been completed to **NGET's** satisfaction in which case **NGET** will issue an

Interim Operational Notification. Where CC.3.3.2(a) applies the **Network Operator** shall determine whether or not the items submitted by the **LEEMPS/DCC** have been completed to its satisfaction prior to allowing the **LEEMPS/DCC** to synchronise.

CC.4.3.5 ***Issue of ION:*** If the requirements of CC.4.3.2 and CC.4.3.4 have been successfully met, **NGET** will notify the **Generator** or **DC Converter Station** owner (or where a **Network Operator CC Compliance Notice** applies **NGET** will notify the **Network Operator** in respect of the **LEEMPS/DCCS**) that the:

Generating Unit,
CCGT Module,
Power Park Module or
DC Converter,

as applicable may (subject to the **Generator** or **DC Converter Station** owner having fulfilled the requirements of CC.4.3.3 where that applies) be **Synchronised** to the **Total System** through the issue of an **Interim Operational Notification**.

CC.4.3.6 ***ION Period:*** The **Interim Operational Notification** will be time limited, the expiration date being specified at the time of issue of the **Interim Operation Notification**, but may be renewed by **NGET**.

CC.4.3.7 ***Meeting ION:*** The **Generator** or **DC Converter Station** owner must operate (or where CC.3.3.4(b) applies the **Network Operator** shall ensure that the **LEEMPS/DCCS** operates) the **Generating Unit**, **CCGT Module**, **Power Park Module** or **DC Converter** in accordance with the terms, arising from the **Unresolved Issues**, of the **Interim Operational Notification**. Where practicable, **NGET** will discuss such terms with the **Generator** or **DC Converter Station** owner prior to including them in the **Interim Operational Notification**.

CC.4.3.8 ***Power Park Modules:***

(a) In the case of a **Power Park Module** the **Interim Operational Notification** will limit the proportion of the **Power Park Module** which can be simultaneously **Synchronised** to the **Total System** such that neither of the following figures is exceeded:

(i) 20% of the **Registered Capacity** of the **Power Park Module** (or the output of a single **Power Park Unit** where this exceeds 20% of the **Power Station**'s **Registered Capacity**); nor

(ii) 50MW

until the **Generator** has completed the voltage control tests with at least one **Power Park Unit** in service in accordance with CC.A.14.2 to **NGET**'s reasonable satisfaction whereupon the provisions of CC.4.3.7 shall apply. Following successful completion of this test each additional **Power Park Unit** should be included in the voltage control scheme as soon as is technically possible (unless **NGET** agrees otherwise).

(b) In the case of a **Power Park Module** with a **Registered Capacity** greater or equal to 100MW, the **Interim Operational Notification** will limit the proportion of the **Power Park Module** which can be simultaneously **Synchronised** to the **Total System** to 70% of **Registered Capacity** until the **Generator** has completed the **Limited frequency Sensitive Mode** control tests with at least 50% of the **Registered Capacity** of the **Power Park Module** in service (detailed in CC.A.14.3) to **NGET**'s reasonable satisfaction.

CC.4.3.9 ***Effect of ION:*** Operation in accordance with the **Interim Operational Notification** whilst it is in force will meet the requirements for compliance by the **Generator** or **DC Converter Station** owner and **NGET** of all the relevant provisions of the **Connection Conditions**.

CC.4.3.10 ***Unresolved Issues:*** Other than **Unresolved Issues** that are subject to tests required under CC.5.5 to be witnessed by **NGET**, the **Generator** or **DC Converter Station** owner must resolve any **Unresolved Issues** prior to the commencement of the tests, unless **NGET** agrees to a later resolution. The **Generator** or **DC Converter Station** owner must liaise with **NGET** in respect of such resolution. The tests that may be witnessed by **NGET** are specified in CC.5.5.

CC.4.3.11 ***Test Notice:*** Not less than 28 days, or such shorter period as may be acceptable in **NGET's** reasonable opinion, prior to the **Generator** or **DC Converter Station** owner wishing to commence tests required under CC.5.5 to be witnessed by **NGET**, the **Generator** or **DC Converter Station** owner will notify **NGET** that the **Generating Unit(s)**, **CCGT Module(s)**, **Power Park Module(s)** or **DC Converter(s)** as applicable is ready to commence such tests.

CC.4.3.12 ***Post Test Submissions:*** The items referred to at CC.5.4 shall be submitted by the **Generator** or the **DC Converter Station** owner after successful completion of the tests required under CC.5.5.

Final Operational Notification

CC.4.4 The following provisions apply in relation to the issue of a **Final Operational Notification.**

CC.4.4.1 ***Test Assessment:*** **NGET** shall assess the items submitted by the **Generator** or **DC Converter Station** owner under CC.4.3.12 to determine whether or not such items have been completed to **NGET's** satisfaction so as to enable **NGET** to issue a **Final Operational Notification**.

CC.4.4.2 ***Issue of FON:*** If the requirements of CC.4.4.1 have been successfully met, **NGET** will notify the **Generator** or **DC Converter Station** owner (or in the case of **LEEMPS/DCCS** where a **Network Operator CC Compliance Notice** applies, the **Network Operator** with a copy being sent to the **LEEMPS/DCCS**) that compliance with the relevant **Grid**

Code provisions has been demonstrated for the **Generating Unit(s)**, **CCGT Module(s)**, **Power Park Module(s)** or **DC Converter(s)** as applicable through the issue of a **Final Operational Notification**.

Limited Operational Notification

CC.4.5 The following provisions of CC.4.5 detail the process to be followed if the **Generator** or **DC Converter Station** owner becomes aware, or **NGET** becomes aware through monitoring, following the issue of a **Final Operational Notification** that its **Plant** and/or **Apparatus'** capability to meet any provisions of the **Grid Code,** or where applicable with Appendices F1 to F5 (or Appendix E in the case of **LEEMPS/DCCS)** of the **Bilateral Agreement** is not fully available. Ongoing compliance process with **LEEMPS/DCCS** is the responsibility of the **Network Operator** within whose **System** the **LEEMPS/DCCS** is **Embedded**.

(a) If the nature of such unavailability causes or can reasonably be expected to cause a material adverse effect on the business or condition of **NGET** or other **Users** or the **GB Transmission System** or any **User Systems** then **NGET** may, notwithstanding the provisions of this CC.4.5, follow the provisions of Paragraph 5.4 of the **CUSC**.

(b) Other than that, operation in accordance with the **Limited Operational Notification** whilst it is force and compliance with the following provisions of CC.4.5, will meet the requirements for compliance by the **User** and **NGET** with all the relevant provisions of the **Connection Conditions**.

CC.4.5.1 ***Non-compliance:*** Immediately upon a **Generator** or **DC Converter Station** owner becoming aware that its **Generating Unit**, **CCGT Module**, **Power Park Module** or **Power Station** as applicable may be unable to comply with certain provisions of the **Grid Code** or (where applicable) with Appendices F1 to F5 (or Appendix E in the case of **LEEMPS/DCCS)** of the **Bilateral Agreement,** the **Generator** or **DC Converter Station** owner shall notify **NGET** in writing including details of any operating restrictions or changes in applicable data arising from the potential non-compliance and an indication of the date from when the restrictions will be removed and full compliance demonstrated.

CC.4.5.2 ***Establishment of Non-compliance:*** If:

(i) the restriction notified pursuant to CC.4.5.1 has not been resolved to **NGET's** satisfaction within 28 days of the date of such notification, the **Generator** and **DC Converter Station** owner shall notify **NGET** as to the reasons for the continued restriction;

(ii) **NGET** and the **Generator** or **DC Converter Station** owner agree that a restriction in respect of certain **Plant** and **Apparatus** (which may have entailed certain investigative

testing being undertaken pursuant to OC5.5) exists such that the **Generator's** or **DC Converter Station** owner's compliance with the **Grid Code** is not being demonstrated; or

(iii) **NGET** becomes aware from monitoring undertaken pursuant to OC.5.4.2.2 (b) that the specified capability is not fully available.

the following provisions of CC.4.5.3 to CC.4.5.6 shall be followed.

CC.4.5.3 ***Investigation:*** In the case of CC.4.5.2(i), the **Generator** or **DC Converter Station** owner and **NGET,** with input from the **Network Operator** where the **Generating Unit**, **CCGT Module**, **Power Park Module** or **Power Station** as applicable is **Embedded,** shall undertake an investigation to attempt to determine the causes of and solution to the non-compliance. Such investigation shall continue for no longer than 56 days from the date of the **Generator's** or **DC Converter Station** owner's notification pursuant to CC.4.5.2(i). During such investigation the **Generator** or **DC Converter Station** owner shall provide to **NGET** the relevant data which has changed due to the restriction in respect of CC.5.3.1 and CC.5.4.1 as notified to the **Generator** or **DC Converter Station** owner by **NGET** as being required to be provided.

CC.4.5.4 ***Issue and Effect of LON:***

(a) If:

(i) by the end of the 56 day period referred to at CC.4.5.3, the investigation has not resolved the non-compliance to **NGET's** satisfaction; or

(ii) a compliance issue identified under CC4.5.2(ii) continues,

then **NGET** will issue to the **Generator** or **DC Converter Station** owner a **Limited Operational Notification**. The **Limited Operational Notification** will be time limited.

(b) Subject to CC.4.5.6, the **Limited Operational Notification** shall be for a period which expires no later than 12 months from in the case of:

(i) CC.4.5.2(i) the initial notification either by the **Generator** or **DC Converter Station** owner to **NGET** of the potential non-compliance pursuant to CC.4.5.1; or

(ii) CC.4.5.2(ii) the date when **NGET** and the **Generator** or **DC Converter Station** owner agreed that a restriction exists.

(c) The **Generator** or **DC Converter Station** owner must operate the **Generating Unit(s)**, **CCGT Module(s)**, **Power Park Module(s)** or **DC Converter(s)** in accordance with the restrictions notified by the **Generator** or **DC Converter Station** owner or agreed with **NGET** pursuant to CC.4.5.1 and/or

CC.4.5.2 and must resolve the **Unresolved Issues** as specified in the **Limited Operational Notification**.

(d) The provisions of CC.4.3.10 to CC.4.4.2 and CC.5.5 (in respect of the **Unresolved Issues** and to the extent in **NGET**'s view reasonably necessary) shall apply and shall be followed where a **Limited Operational Notification** has been issued, such that where the **Unresolved Issues** have been resolved a **Final Operational Notification** will be issued to the **User**. In respect of selecting the extent of, and time for, any tests which may in **NGET**'s view reasonably be needed to demonstrate the restored capability, **NGET** shall, where reasonably practicable, take account of the **Generator** or **DC Converter Station** owner's input to contain its costs associated with the testing.

(e) The provisions of CC.3.3.6 apply in respect of **LEEMPS/DCCS.**

CC.4.5.5 ***Derogation:*** If a **Final Operational Notification** has not been issued by **NGET** within the 12 month period referred to at CC.4.5.4 then the **Generator** or **DC Converter Station** owner (where licensed in respect of its activities) and **NGET** shall apply to the **Authority** for a derogation. Whilst the **Authority** is considering the application, the **Limited Operational Notification** will be extended to remain in force until the **Authority** has notified **NGET** and the **Generator** or **DC Converter Station** owner of its decision. Where the **Generator** or **DC Converter Station** owner is not licensed **NGET** reserves the right to make any necessary changes to the **Bilateral Agreement** with such unlicensed **Generator** or **DC Converter Station** owner.

CC.4.5.6 ***Authority Decision:*** If the **Authority**:

(a) grants a derogation in respect of the **Plant** and/or **Apparatus**, then **NGET** shall issue an appropriate **Operational Notification**; or

(b) decides not to grant any derogation in respect of the **Plant** and/or **Apparatus,** then there will be no **Operational Notification** in place and **NGET** shall consider its rights pursuant to the **CUSC**.

CC.4.5.7 ***Unresolved Issues:*** Where a **Limited Operational Notification** is so conditional upon a derogation and such derogation includes any conditions (including any time limit to such derogation) the **Generator** or **DC Converter Station** owner will progress the resolution of any **Unresolved Issues** and / or progress and / or comply with any conditions upon such derogation and the provisions of CC.4.3.10 to CC.4.4.2 and CC.5.5 shall apply and shall be followed. In respect of selecting the extent of, and time for, any tests which may in **NGET**'s view reasonably be needed to demonstrate the derogated capability, **NGET** shall, where reasonably practicable, take account of the **Generator** or **DC Converter Station** owner's input to contain its costs associated with the testing.

Manufacturer's Data & Performance Report for Power Parks

CC.4.6 Data and performance characteristics in respect of certain **Grid Code** requirements may be registered with **NGET** by **Power Park Unit** manufacturers in respect of specific models of **Power Park Units** by submitting information in the form of a **Manufacturer's Data and Performance Report** to **NGET**.

A **Generator** planning to construct a new **Power Station** containing the appropriate version of **Power Park Units** in respect of which a **Manufacturer's Data & Performance Report** has been submitted to **NGET** may reference the **Manufacturer's Data & Performance Report** in its submissions to **NGET**. Any **Generator** considering referring to a **Manufacturer's Data & Performance Report** for any aspect of its **Plant** and **Apparatus** is advised to contact **NGET** to discuss the suitability of the relevant **Manufacturer's Data & Performance Report** to its project to determine if, and to what extent, the data included in the **Manufacturer's Data & Performance Report** contributes towards demonstrating compliance with those aspects of the **Grid Code** applicable to the **Generator**. **NGET** will inform the **Generator** if the reference to the **Manufacturer's Data & Performance Report** is not appropriate or not sufficient for its project.

The process to be followed by **Power Park Unit** manufacturers in respect of the **Manufacturer's Data & Performance Report** in respect of a specific **Grid Code** requirement must be agreed by **NGET**. However, CC.4.6.1 indicates the areas in respect of which a **Manufacturer's Data & Performance Report** may be submitted.

NGET will maintain and publish a register of those **Manufacturer's Data & Performance Reports** which **NGET** has received and accepted as being an accurate representation of the performance of the relevant **Plant** and / or **Apparatus**. Such register will identify the date on which the report is received by **NGET**, the manufacturer, the model(s) of **Power Park Unit(s)** to which the report applies and the provisions of the **Grid Code** in respect of which the report contributes towards the demonstration of compliance. The inclusion of any report in the register does not in any way confirm that any **Power Park Modules** which utilise any **Power Park Unit(s)** covered by a report is or will be compliant with the **Grid Code**.

CC.4.6.1 A **Manufacturer's Data & Performance Report** in respect of **Power Park Units** may cover one (or part of one) or more of the following provisions of the **Grid Code**:

(a) Fault Ride Through capability **CC.6.3.15**

(b) Reactive Capability **CC.6.3.2**

(c) Voltage Control **CC.6.3.6, CC.6.3.8, CC.A.7**

(d) Frequency Control **CC.6.3.6, CC.6.3.7, CC.A.3**

(e) Power Park Module mathematical model **PC.A.5.4.2**

(f) Fault in-feed contribution **PC.A.2.5.5.7**

CC.4.6.2 Reference to a **Manufacturer's Data & Performance Report** in a **User's** submissions does not by itself constitute compliance with the **Grid Code**.

CC.4.6.3 A **Generator** referencing a **Manufacturer's Data & Performance Report** should insert the relevant **Manufacturer's Data & Performance Report** reference in the appropriate place in the **DRC** data submission and / or in the **User Data File Structure**. **NGET** will consider the suitability of a **Manufacturer's Data & Performance Report** in place of the following:

(a) **DRC** data submissions:

(i) A mathematical model suitable for representation of the entire **Power Park Module** as per CC.A.8.4.4. For the avoidance of doubt only for the relevant sections as specified in PC.A.2.5.5.7 apply. Site specific parameters will still need to be submitted by the **Generator**.

(ii) **DRC** Schedule 14 full site specific fault in-feed information (PC.A.2.5.6(a)(vii). For the avoidance of doubt this option still requires a complete **DRC** schedule 5 submission.

(b) Fault simulation studies:

NGET will no longer require Fault Ride Through simulation studies to be conducted as per CC.A.8.5.1 and qualified in CC.A.8.5.2 provided that:

(i) Adequate and relevant **Power Park Unit** data is included in respect of Fault Ride Through testing covered in CC.A.14.7.1 in the relevant **Manufacturer's Data & Performance Report** , and

(ii) For each type and duration of fault as detailed in CC.A.8.5.1, the expected minimum retained voltage is greater than the corresponding minimum voltage achieved and successfully ridden through in the **Manufacturer's Data & Performance Report**.

(c) Reduced scope of tests:

Where there is a **Manufacturer's Data & Performance Report** in respect of a **Power Park Unit** which covers one or more of the following

(i) Reactive range

(ii) Voltage control

(iii) Frequency control

NGET may agree a reduced scope of tests to demonstrate compliance with the **Grid Code** depending on the data within the **Manufacturer's Data & Performance Report** and the control methodology in operation at the **Generator**'s site. This should be discussed and agreed between **NGET** and the **Generator**.

CC.4.6.4 It is the responsibility of the **User** to ensure that the correct reference for the **Manufacturer's Data & Performance Report** is used. **NGET** may contact the **Power Park Unit** manufacturer directly to verify the relevance of the use of such **Manufacturer's Data & Performance Report**. If **NGET** believe the use of such **Manufacturer's Data & Performance Report** is incorrect or the referenced data is inappropriate then permission to use the **Manufacturer's Data & Performance Report** may be refused by **NGET**. Where, and to the extent possible, the data included in the **Manufacturer's Data & Performance Report** is appropriate, the compliance assessment process will be continued using the data included in the **Manufacturer's Data & Performance Report.**

CC.5. CONNECTION

CC.5.1 The provisions relating to connecting to the **GB Transmission System** (or to a **User**~~''~~**s System** in the case of a connection of an **Embedded Large Power Station**, or **Embedded Medium Power Station** ~~or **Embedded DC Converter Station**~~, or **LEEMPS/DCCS**) are contained in

the **CUSC** and/or **CUSC Contract** (or in the relevant application form or offer for a **CUSC Contract**);

(a) or, in the case of an **Embedded Development**, the relevant **Distribution Code** and/or the **Embedded Development Agreement** for the connection (or in the relevant application form or offer for an **Embedded Development Agreement**),

and include provisions relating to both the submission of information and reports relating to compliance with the relevant **Connection Conditions** for that **User**, **Safety Rules**, commissioning programmes, **Operation Diagrams** and approval to connect (and their equivalents in the case of ~~**Embedded Medium Power Stations** not subject to a **Bilateral Agreement** or **Embedded DC Converter Stations** not subject to a **Bilateral Agreement**~~**LEEMPS/DCCS**). References in the **CC** to the ~~"~~"**Bilateral Agreement**" and/or "**Construction Agreement**~~"~~" and/or "**Embedded Development Agreement**" and/or "**CUSC Contract**" shall be deemed to include references to the application form or offer ~~therefor~~therefore.

CC.5.2 Items for submission prior to the issue of an **Energisation Operational Notification**

CC5.2.1 ~~Prior~~In the case of a **Generator** or **DC Converter Station** owner connecting to the **GB Transmission System,** prior to the **Completion Date** under the **Bilateral Agreement** and/or **Construction Agreement**, and prior to the issue of an **Energisation Operational Notification,** the following is submitted pursuant to the terms of the **Bilateral Agreement** and/or **Construction Agreement**:

(a) updated **Planning Code** data (both **Standard Planning Data** and **Detailed Planning Data**), with any estimated values assumed for planning purposes confirmed or, where practical, replaced by validated actual values and by updated estimates for the future and by updated forecasts for **Forecast Data** items such as **Demand**, pursuant to the requirements of the **Planning Code**;

(b) details of the **Protection** arrangements and settings referred to in CC.~~6~~6, and/or the **Bilateral Agreement**;

(c) copies of all **Safety Rules** and **Local Safety Instructions** applicable at **Users'' Sites** which will be used at the **NGET/User** interface (which, for the purpose of **OC8,** must be to **NGET's** satisfaction regarding the procedures for **Isolation** and **Earthing**. For **User Sites** in Scotland **NGET** will consult the **Relevant Transmission Licensee** when determining whether the procedures for **Isolation** and **Earthing** are satisfactory);

(d) information to enable **NGET** to prepare **Site Responsibility Schedules** on the basis of the provisions set out in Appendix 1;

(e) an **Operation Diagram** for all **HV Apparatus** on the **User** side of the **Connection Point** as described in CC.7;

(f) the proposed name of the **User Site** (which shall not be the same as, or confusingly similar to, the name of any **Transmission Site** or of any other **User Site**);

(g) written confirmation that **Safety Coordinators** acting on behalf of the **User** are authorised and competent pursuant to the requirements of **OC8**;

(h) **RISSP** prefixes pursuant to the requirements of **OC8. NGET** is required to circulate prefixes utilising a proforma in accordance with **OC8**;

a list of the telephone numbers for **Joint System Incidents** at which senior management representatives nominated for the purpose can be contacted and confirmation that they are fully authorised to make binding decisions on behalf of the **User**,

pursuant to **OC9**;

(j) a list of managers who ~~have been~~are duly authorised to sign **Site Responsibility Schedules** on behalf of the **User**;

(k) information to enable **NGET** to prepare **Site Common Drawings** as described in CC.7;

(l) a list of the telephone numbers for the **Users** facsimile machines referred to in CC.6.5.9; and

(m) for **Sites** in Scotland a list of persons appointed by the **User** to undertake operational duties on the **User's System** and to issue and receive operational messages and instructions in relation to the **User's System**; and an appointed person or persons responsible for the maintenance and testing of **User's Plant** and **Apparatus**.

CC.5.2.2 ~~prior~~Prior to the **Completion Date** the following must be submitted to **NGET** by the **Network Operator** in respect of an **Embedded Development** (except in the case where CC.3.3.2(b) applies in relation to a **LEEMPS/DCCS**, where **NGET** will obtain the information and will record it):

(a) updated **Planning Code** data (both **Standard Planning Data** and **Detailed Planning Data**), with any estimated values assumed for planning purposes confirmed or, where practical, replaced by validated actual values and by updated estimates for the future and by updated forecasts for **Forecast Data** items such as **Demand**, pursuant to the requirements of the **Planning Code**;

(b) details of the **Protection** arrangements and settings referred to in CC.6 and/or the **Bilateral Agreement**;

(c) ~~the proposed name of~~ information to enable **NGET** to prepare **Site Responsibility Schedules** on the basis of the provisions set out in Appendix 1 (but only where the **Embedded** ~~**Medium**~~ **Power Station** or the **Embedded DC Converter Station** is within a **Connection Site** with another **User**);

(d) the proposed name of the **LEEMPS/DCCS Site** (which shall be agreed with **NGET** unless it is the same as, or confusingly similar to, the name of other **Transmission Site** or **User Site**);

~~CC.5.3 (a) Of the items CC.5.2.1 (c), (e), (g), (h), (k) and (m) need not be supplied in respect of **Embedded Power Stations** or **Embedded DC Converter Stations**,~~

~~(b) item CC.5.2.1(i) need not be supplied~~e) a list of the telephone numbers for **Joint System Incidents** at which senior management representatives nominated for the purpose can be

contacted and confirmation that they are fully authorised to make binding decisions on behalf of the **User**, pursuant to **OC9** (except in respect of **Embedded Small Power Stations** and **Embedded Medium Power Stations** or **Embedded DC Converter Stations** with a **Registered Capacity** of less than 100MW~~, and~~);

(~~e~~f) ~~items CC.5.2.1(d) and (j) are only needed in the case~~ a list of managers who are duly authorised to sign **Site Responsibility Schedules** on behalf of the **User** (but only where the **Embedded Power Station** or the **Embedded DC Converter Station** is within a **Connection Site** with another **User**~~.~~);

(g) a list of the telephone numbers for the **Users** facsimile machines referred to in CC.6.5.9;

CC.~~5.4~~5.2.3 In addition, at the time the information is given under CC.~~5.2~~5.2.1(g), **NGET** will provide written confirmation to the **User** that the **Safety Co-ordinators** acting on behalf of **NGET** are authorised and competent pursuant to the requirements of **OC8**.

CC.5.2.4 The items referred to in CC.5.2 shall be submitted by the **Generator** or **DC Converter Station** owner or **Network Operator** (or in the case where CC.3.4.4 applies, recorded by **NGET**) using the **User Data File Structure**.

CC.5.3 Items for submission prior to issue of the **Interim Operational Notification**

CC.5.3.1 Prior to the issue of an **Interim Operational Notification** the **Generator** or **DC Converter Station** owner must submit to **NGET** to **NGET's** satisfaction:

(a) updated **Planning Code** data (both **Standard Planning Data** and **Detailed Planning Data**), with any estimated values assumed for planning purposes confirmed or, where practical, replaced by validated actual values and by updated estimates for the future and by updated forecasts for **Forecast Data** items such as **Demand;**

(b) details of any special **Power Station**, **Generating Unit(s)**, **Power Park Module(s)** or **DC Converter Station(s)** protection as applicable. This may include Pole Slipping protection and islanding protection schemes;

(b) any items required by CC.5.2, updated by the **User** as necessary;

(c) simulation study provisions of Appendix CC.A.8 and the results demonstrating compliance with **Grid Code** requirements of:

PC.A.5.4.2
PC.A.5.4.3.2.

CC.6.3.4,
CC.6.3.7(c)(i),
CC.6.3.15,
CC.A.6.2.5.6

as applicable to the **Power Station**, **Generating Unit(s)**, **Power Park Module(s)** or **DC Converter(s)** unless agreed otherwise by **NGET**;

(d) a detailed schedule of the tests and the procedures for the tests required to be carried out by the **Generator** or **DC Converter Station** owner under CC.5.5 to demonstrate compliance with relevant **Grid Code** requirements. Such schedule to be consistent with Appendix CC.A.13 (in the case of **Generating Units** other than **Power Park Modules**) or Appendix CC.A.14 (in the case of **Generating Units** comprising **Power Park Modules**); and

(e) an interim **Compliance Statement** and a **User Self Certification of Compliance** completed by the **User** (including any **Unresolved Issues**) against the relevant **Grid Code** requirements including details of any requirements that the **Generator** or **DC Converter Station** owner has identified that will not or may not be met or demonstrated.

CC.5.3.2 The items referred to in CC.5.3.1 shall be submitted by the **Generator** or **DC Converter Station** owner using the **User Data File Structure**.

CC.5.4 Items for submission prior to issue of the **Final Operational Notification**

CC.5.4.1 Prior to the issue of a **Final Operational Notification** the **Generator** or **DC Converter Station** owner must submit to **NGET** to **NGET's** satisfaction:

(a) updated **Planning Code** data (both **Standard Planning Data** and **Detailed Planning Data**), with validated actual values and by updated estimates for the future and by updated forecasts for **Forecast Data** items such as **Demand**;

(b) any items required by CC.5.2 and CC.5.3, updated by the **User** as necessary;

(c) evidence to **NGET's** satisfaction that demonstrates that the controller models and/or parameters (as required under PC.A.5.3.2(c) option 2, PC.A.5.3.2(d) option 2, PC.A.5.4.2, and/or PC.A.5.4.3.2) supplied to **NGET** provide a reasonable representation of the behaviour of the **User's Plant** and **Apparatus**;

(d) results from the tests required in accordance with CC.5.5 carried out by the **Generator** to demonstrate compliance with relevant

Grid Code requirements including the tests witnessed by **NGET**; and

(e) the final **Compliance Statement** and a **User Self Certification of Compliance** signed by the **User** and a statement of any requirements that the **Generator** or **DC Converter Station** owner has identified that have not been met together with a copy of the derogation in respect of the same from the **Authority**.

CC.5.4.2 The items in CC.5.4.1 should be submitted by the **Generator** or **DC Converter Station** owner using the **User Data File Structure**.

CC.5.5 Tests to be carried out prior to issue of the **Final Operational Notification**

CC.5.5.1 Prior to the issue of a **Final Operational Notification** the **Generator** or **DC Converter Station** owner must have completed the tests specified in this CC.5.5.1 to demonstrate compliance with the relevant **Grid Code** provisions.

CC.5.5.1.1 In the case of any **Generating Unit**, **CCGT Module, Power Park Module** and **DC Converter** these tests will comprise one or more of the following:

(a) reactive capability tests to demonstrate that the **Generating Unit**, **CCGT Module, Power Park Module** and **DC Converter** can meet the requirements of CC.6.3.2. These may be witnessed by **NGET** on site if there is no metering to the **NGET** Control Centre.

(b) voltage control system tests to demonstrate that the **Generating Unit**, **CCGT Module**, **Power Park Module** and **DC Converter** can meet the requirements of CC.6.3.6, CC.6.3.8 and, in the case of **Power Park Module** and **DC Converter,** the requirements of CC.A.6 and, in the case of **Generating Unit** and **CCGT Module,** the requirements of CC.A.7, and any terms specified in the **Bilateral Agreement** as applicable. These tests may also be used to validate the **Excitation System** model or voltage control system model as applicable. These tests may be witnessed by **NGET**.

(c) governor or frequency control system tests to demonstrate that the **Generating Unit**, **CCGT Module** and **Power Park Module** can meet the requirements of CC.6.3.6, CC.6.3.7, CC.A.3 and BC.3.7. The results will also validate the **Mandatory Service Agreement** required by CC.8.1. These tests may also be used to validate the Governor model or frequency control system model as applicable. These tests may be witnessed by **NGET**.

(d) any further tests reasonably required by **NGET** and agreed with the **User** to demonstrate any aspects of compliance with the **Grid Code** and the **CUSC Contracts.**

CC.5.5.2 Following completion of each of the tests specified in this CC.5.5, **NGET** will notify the **Generator** or **DC Converter Station** owner whether, in the opinion of **NGET**, the results demonstrate compliance with the relevant **Grid Code** conditions.

CC.5.5.3 The **Generator** or **DC Converter Station** owner is responsible for carrying out the tests and retains the responsibility for safety and personnel during the test.

CC.5.5.4 **NGET**'s preferred range of tests to demonstrate compliance with the **CCs** are specified in Appendix CC.A.13 (in the case of **Generating Units** other than **Power Park Modules**) or Appendix CC.A.14 (in the case of **Generating Units** comprising **Power Park Modules**) and are to be carried out by the **User** and the results of such tests are to be provided to **NGET**. The **User** may carry out an alternative range of tests if this is agreed with **NGET**.

. . . . . .

2. Amend Appendix 6 to the CC as follows:

APPENDIX 6

PERFORMANCE REQUIREMENTS FOR CONTINUOUSLY ACTING AUTOMATIC EXCITATION CONTROL SYSTEMS FOR **SYNCHRONOUS GENERATING UNITS**

CC.A.6.1 SCOPE

CC.A.6.1.1 This Appendix sets out the performance requirements of continuously acting automatic excitation control systems for **Synchronous Generating Units** that must be complied with by the **User**. This Appendix does not limit any site specific requirements that may be included in a **Bilateral Agreement** where in **NGET's** reasonable opinion these facilities are necessary for system reasons.

CC.A.6.1.2 Where the requirements may vary the likely range of variation is given in this Appendix. It may be necessary to specify values outside this range where **NGET** identifies a system need, and notwithstanding anything to the contrary **NGET** may specify in the **Bilateral Agreement** values outside of the ranges provided in this Appendix 6. The most common variations are in the on-load excitation ceiling voltage requirements and the response time required of the **Exciter.** Actual values will be included in the **Bilateral Agreement**.

CC.A.6.1.3 Should a **Generator** anticipate making a change to the excitation control system it shall notify **NGET** under the **Planning Code** (PC.A.1.2(b) and

(c)) as soon as the **Generator** anticipates making the change. The change may require a revision to the **Bilateral Agreement**.

CC.A.6.2 Requirements

CC.A.6.2.1 The **Excitation System** of a **Synchronous Generating Unit** shall include an excitation source (**Exciter**), a **Power System Stabiliser** and a continuously acting **Automatic Voltage Regulator** (**AVR**) and shall meet the following functional specification.

CC.A.6.2.2 In respect of **Synchronous Generating Units** with a **Completion Date** on or after 1 January 2009, and **Synchronous Generating Units** with a **Completion Date** before 1 January 2009 subject to a **Modification** to the excitation control facilities where the **Bilateral Agreement** does not specify otherwise, the continuously acting automatic excitation control system shall include a **Power System Stabiliser (PSS)** as a means of supplementary control. The functional specification of the **Power System Stabiliser** is included in CC.A.6.2.5.

CC.A.6.2.3 Steady State Voltage Control

CC.A.6.2.3.1 An accurate steady state control of the **Generating Unit** pre-set terminal voltage is required. As a measure of the accuracy of the steady-state voltage control, the **Automatic Voltage Regulator** shall have static zero frequency gain, sufficient to limit the change in terminal voltage to a drop not exceeding 0.5% of rated terminal voltage, when the **Generating Unit** output is gradually changed from zero to rated MVA output at rated voltage, **Active Power** and **Frequency**.

CC.A.6.2.4 Transient Voltage Control

CC.A.6.2.4.1 For a step change from 90% to 100% of the nominal **Generating Unit** terminal voltage, with the **Generating Unit** on open circuit, the **Excitation System** response shall have a damped oscillatory characteristic. For this characteristic, the time for the **Generating Unit** terminal voltage to first reach 100% shall be less than 0.6 seconds. Also, the time to settle within 5% of the voltage change shall be less than 3 seconds.

CC.A.6.2.4.2 To ensure that adequate synchronising power is maintained, when the **Generating Unit** is subjected to a large voltage disturbance, the **Exciter** whose output is varied by the **Automatic Voltage Regulator** shall be capable of providing its achievable upper and lower limit ceiling voltages to the **Generating Unit** field in a time not exceeding that specified in the **Bilateral Agreement**. This will normally be not less than 50 ms and not greater than 300 ms. The achievable upper and lower limit ceiling voltages may be dependent on the voltage disturbance.

CC.A.6.2.4.3 The **Exciter** shall be capable of attaining an **Excitation System On Load Positive Ceiling Voltage** of not less than a value specified in the **Bilateral Agreement** that will be

not less than 2 per unit (pu)
normally not greater than 3 pu
exceptionally up to 4 pu

of **Rated Field Voltage** when responding to a sudden drop in voltage of 10 percent or more at the **Generating Unit** terminals. **NGET** may specify a value outside the above limits where **NGET** identifies a system need.

CC.A.6.2.4.4 If a static type **Exciter** is employed:

(a) ~~(i)~~ the field voltage should be capable of attaining a negative ceiling level specified in the **Bilateral Agreement** after the removal of the step disturbance of CC.A.6.2.4.3. The specified value will be 80% of the value specified in CC.A.6.2.4.3. **NGET** may specify a value outside the above limits where **NGET** identifies a system need~~.~~

(b) ~~(ii)~~ the **Exciter** must be capable of maintaining free firing when the **Generating Unit** terminal voltage is depressed to a level which may be between 20% to 30% of rated terminal voltage

(c) ~~(iii)~~ the **Exciter** shall be capable of attaining a positive ceiling voltage not less than 80% of the **Excitation System On Load Positive Ceiling Voltage** upon recovery of the **Generating Unit** terminal voltage to 80% of rated terminal voltage following fault clearance. **NGET** may specify a value outside the above limits where **NGET** identifies a system need.

(d) ~~(iv)~~ The requirement to provide a separate power source for the **Exciter** will be specified in the **Bilateral Agreement** if **NGET** identifies a **Transmission System** need.

CC.A.6.2.5 Power Oscillations Damping Control

CC.A.6.2.5.1 To allow the **Generating Unit** to maintain second and subsequent swing stability and also to ensure an adequate level of low frequency electrical damping power, the **Automatic Voltage Regulator** shall include a **Power System Stabiliser** as a means of supplementary control.

CC.A.6.2.5.2 Whatever supplementary control signal is employed, it shall be of the type which operates into the **Automatic Voltage Regulator** to cause the field voltage to act in a manner which results in the damping power being improved while maintaining adequate synchronising power.

CC.A.6.2.5.3 The arrangements for the supplementary control signal shall ensure that the **Power System Stabiliser** output signal relates only to changes in the supplementary control signal and not the steady state level of the signal. For example, if generator electrical power output is chosen as a supplementary control signal then the **Power System Stabiliser** output

should relate only to changes in generator electrical power output and not the steady state level of power output. Additionally the **Power System Stabiliser** should not react to mechanical power changes in isolation for example during rapid changes in steady state load or when providing frequency response.

CC.A.6.2.5.4 The output signal from the **Power System Stabiliser** shall be limited to not more than ±10% of the **Generating Unit** terminal voltage signal at the **Automatic Voltage Regulator** input. The gain of the **Power System Stabiliser** shall be such that an increase in the gain by a factor of 3 shall not cause instability.

CC.A.6.2.5.5 The **Power System Stabiliser** shall include elements that limit the bandwidth of the output signal. The bandwidth limiting must ensure that the highest frequency of response cannot excite torsional oscillations on other plant connected to the network. A bandwidth of 0-5Hz would be judged to be acceptable for this application.

CC.A.6.2.5.6 The **Generator** will agree **Power System Stabiliser** settings with **NGET** prior to the on-load commissioning detailed in BC2.11.2(d). To allow assessment of the performance before on-load commissioning the **Generator** will provide to **NGET** a report ~~containing:~~ covering the areas specified in CC.A.8.2.

~~i. the **Excitation System** model including the **Power System Stabiliser** with settings as required under the **Planning Code** (PC.A.5.3.2(c)).~~

~~ii. on load time series simulations of the response of the **Excitation System** with and without the **Power System Stabiliser** to 2% and 10% steps in the reference voltage and a three phase short circuit fault applied to the higher voltage side of the **Generating Unit** transformer for 100 ms. The results should show field voltage, **Generating Unit** terminal voltage, **Power System Stabiliser** output and **Generating Unit Active Power** and **Reactive Power** output.~~

~~iii. gain and phase Bode diagrams for the open loop frequency domain response of the **Generating Unit Excitation System** with and without the **Power System Stabiliser**. These should be in a format to allow assessment of the phase contribution of the **Power System Stabiliser** and the gain and phase margin of the **Excitation System** with the **Power System Stabiliser**.~~

CC.A.6.2.5.7 The **Power System Stabiliser** must be active within the **Excitation System** at all times when ~~**Synchronised**~~**synchronised** including when the **Under Excitation Limiter** or **Over-Excitation Limiter** are active. When operating at low load when **Synchronising** or **De-Synchronising** a **Generating Unit**~~,~~ the **Power System Stabiliser** may be out of service**.**

CC.A.6.2.5.8 Where a **Power System Stabiliser** is fitted to a **Pumped Storage Unit** it must function when the **Pumped Storage Unit** is in both generating and pumping modes.

CC.A.6.2.6 Overall **Excitation System** Control Characteristics

CC.A.6.2.6.1 The overall **Excitation System** shall include elements that limit the bandwidth of the output signal. The bandwidth limiting must be consistent with the speed of response requirements and ensure that the highest frequency of response cannot excite torsional oscillations on other plant connected to the network. A bandwidth of 0-5 Hz will be judged to be acceptable for this application.

CC.A.6.2.6.2 The response of the **Automatic Voltage Regulator** combined with the **Power System Stabiliser** shall be demonstrated by injecting similar step signal disturbances into the **Automatic Voltage Regulator** reference ~~with the **Generating Unit** operating at points specified by **NGET** (up to rated MVA output)~~as detailed in CC.A.13.2 and CC.A.13.4. **The Automatic Voltage Regulator** shall include a facility to allow step injections into the **Automatic Voltage Regulator** reference. The damping shall be judged to be adequate if the corresponding **Active Power** response to the disturbances decays within two cycles of oscillation.

CC.A.6.2.6.3 ~~The~~A facility to inject a band limited random noise signal into the **Automatic Voltage Regulator** reference shall be provided for demonstrating the frequency domain ~~tuning~~response of the **Power System Stabiliser** ~~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 **NGET** (up to rated MVA output).~~ . The tuning of the **Power System Stabiliser** shall be judged to be adequate if the corresponding **Active Power** response shows improved damping with the **Power System Stabiliser** in combination with the **Automatic Voltage Regulator** compared with the **Automatic Voltage Regulator** alone over the frequency range 0.3Hz – 2Hz.

CC.A.6.2.7 **Under-Excitation Limiters**

CC.A.6.2.7.1 The security of the power system shall also be safeguarded by means of MVAr **Under Excitation Limiters** fitted to the generator **Excitation System**. The **Under Excitation Limiter** shall prevent the **Automatic Voltage Regulator** reducing the generator excitation to a level which would endanger synchronous stability. The **Under Excitation Limiter** shall operate when the excitation system is providing automatic control. The **Under Excitation Limiter** shall respond to changes in the **Active Power** (MW) and the **Reactive Power** (MVAr), and to the square of the generator voltage in such a direction that an increase in voltage will permit an increase in leading MVAr. The characteristic of the **Under Excitation Limiter** shall be substantially linear from no-load to rated load at any setting and shall be readily adjustable.

CC.A.6.2.7.2 The performance of the **Under Excitation Limiter** shall be independent of the rate of change of the **Generating Unit** load and shall be demonstrated by testing ~~its response to a step change corresponding to a 2% decrease in **Automatic Voltage Regulator** reference voltage when the generator is operating just off the limit line, as set up.~~as detailed in CC.A.13.5. The resulting maximum overshoot in response to a step injection which operates the **Under Excitation Limiter** shall not exceed

4% of the **Generating Unit** rated MVA. The operating point of the **Generating Unit** shall be returned to a steady state value at the limit line and the final settling time shall not be greater than 5 seconds. When the step change in **Automatic Voltage Regulator** reference voltage is reversed, the field voltage should begin to respond without any delay and should not be held down by the **Under Excitation Limiter**. Operation into or out of the preset limit levels shall ensure that any resultant oscillations are damped so that the disturbance is within 0.5% of the **Generating Unit** MVA rating within a period of 5 seconds.

CC.A.6.2.7.3 The **Generator** shall also make provision to prevent the reduction of the **Generating Unit** excitation to a level which would endanger synchronous stability when the **Excitation System** is under manual control.

CC.A.6.2.8 **Over-Excitation Limiters**

CC.A.6.2.8.1 The settings of the **Over-Excitation Limiter**, where it exists, shall ensure that the generator excitation is not limited to less than the maximum value that can be achieved whilst ensuring the **Generating Unit** is operating within its design limits. If the generator excitation is reduced following a period of operation at a high level, the rate of reduction shall not exceed that required to remain within any time dependent operating characteristics of the **Generating Unit**.

CC.A.6.2.8.2 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 **NGET** and the **Generator**. The resulting~~as detailed in CC.A.13.6 . Any 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.~~CC.A.6.2.8.3 The **Generator** shall also make provision to prevent any over-excitation restriction of the generator when the **Excitation System** is under manual control, other than that necessary to ensure the **Generating Unit** is operating within its design limits.

.....

Amend the following paragraphs of Appendix 7 to CC as follows.

CC.A.7.2.3.1 For an on-load step change in **Grid Entry Point** or **User System Entry Point** voltage, the continuously acting automatic control system shall respond according to the following minimum criteria

i. the **Reactive Power** output response of the **Non-Synchronous Generating Unit**, **DC Converter** or **Power Park Module** shall commence within 0.2 seconds of the application of the step. It shall progress linearly although variations from a linear characteristic shall be acceptable provided that the MVAr seconds delivered at any time up to 1 second are at least those that would result from the response shown in figure CC.A.7.2.3.1a.

ii. the response shall be such that, for a sufficiently large step, 90% of the full reactive capability of the **Non-Synchronous Generating Unit**, **DC Converter** or **Power Park Module**, as required by **CC.6.3.2** (or, if appropriate, **CC.A.7.2.2.6** or **CC.A.7.2.2.7**), will be produced within 1 second

iii. the magnitude of the **Reactive Power** output response produced within 1 second shall vary linearly in proportion to the magnitude of the step change

iv. the settling time shall be no greater than ~~2~~5 seconds from the application of the step change in voltage and the peak to peak magnitude of any oscillations shall be less than 5% of the change in steady state **Reactive Power** within this time.

v. following the transient response, the conditions of CC.A.7.2.2 apply.

NOTE: *Figure CC.A.7.2.3.1a remains as per current Grid Code*

CC.A.7.2.4.1 The requirement for the continuously acting voltage control system to be fitted with a **Power System Stabiliser (PSS)** shall be specified in the **Bilateral Agreement** if, in **NGET's** view, this is required for system reasons. However if a **Power System Stabiliser** is included in the voltage control system its settings and performance shall be agreed with **NGET** and commissioned in accordance with **BC.2.11.2**. To allow assessment of the performance before on-load commissioning the **Generator** will provide to **NGET** a report covering the areas specified in CC.A.8.2.

CC.A.7.2.5.3 The response of the voltage control system (including the **Power System Stabiliser** if employed) shall be demonstrated ~~by applying suitable step disturbances into the voltage control system of the **Power Park Module** or **Power Park Unit**, or by changing the actual voltage at a suitable point, with the generator operating at points specified by **NGET** (up to rated MVA output). The damping shall be judged to be adequate if the corresponding **Active Power** response to the disturbances decays within 2 seconds of the application of the step.~~ in accordance with CC.A.14.4 and CC.A.14.5.

3. Insert a new Appendix CC.A.8 to the CCs regarding Simulation Studies:

Appendix CC.A.8.

CC.A.8.1.1 This Appendix sets out the simulation studies required to be submitted to **NGET** to demonstrate compliance with the Connection Conditions unless otherwise agreed with **NGET**. This Appendix should be read in conjunction with CC.4 and CC.5 with regard to the submission of the reports to **NGET**. Where there is any inconsistency in the technical requirements in respect of which compliance is being demonstrated by simulation in this Appendix and CC.6.3 and the **Bilateral Agreement,** the provisions of the **Bilateral Agreement** and CC.6.3 prevail. The studies specified in this Appendix will normally be sufficient to demonstrate compliance. However **NGET** may agree an alternative set of studies proposed by the **Generator** or **DC Converter Station** owner provided **NGET** deem the alternative set of studies sufficient to demonstrate compliance with the **Grid Code** and the **Bilateral Agreement.**

CC.A.8.1.2 The **Generator** or **DC Converter Station** owner shall submit simulation studies in the form of a report to demonstrate compliance. In all cases the simulation studies must utilise models applicable to the **Generating Unit**, **DC Converter** or **Power Park Module** with proposed or actual parameter settings. Reports should be submitted in English with all diagrams and graphs plotted clearly with legible axes and scaling provided to ensure any variations in plotted values is clear.

Power System Stabiliser Tuning

CC.A.8.2 The **Power System Stabiliser** tuning simulation study report required by CC.A.6.2.5.6, or required by the **Bilateral Agreement** shall contain:

(i) the **Excitation System** model including the **Power System Stabiliser** with settings as required under the **Planning Code** (PC.A.5.3.2(c))

(ii) on load time series dynamic simulation studies of the response of the **Excitation System** with and without the **Power System Stabiliser** to 2% and 10% steps in the reference voltage and a three phase short circuit fault applied to the higher voltage side of the **Generating Unit** transformer for 100ms. The simulation studies should be carried out with the **Generating Unit** operating at full **Active Power** and maximum leading conditions with the fault level at the **Supergrid** HV connection point at minimum or as otherwise agreed with **NGET**. The results should show field voltage, **Generating Unit** terminal voltage, **Power System Stabiliser** output and **Generating Unit Active Power** and **Reactive Power** output.

(iii) gain and phase Bode diagrams for the open loop frequency domain response of the **Generating Unit Excitation System** with and without the **Power System Stabiliser**. These should

be in the format to allow assessment of the phase contribution of the **Power System Stabiliser** and the gain margin and phase margin of the **Excitation System** with the **Power System Stabiliser**.

(iv) an eigenvalue plot to demonstrate that all modes remain stable as **Power System Stabiliser** gain is increased by at least a factor of 3 from the designed operating value.

Reactive Capability across the voltage range

CC.A.8.3.1 The **Generator** or **DC Converter station** owner shall supply simulation studies to demonstrate the capability to meet CC.6.3.4 by submission of a report containing:

(i) a load flow simulation study result to demonstrate the capability of the **Synchronous Generating Unit**, **DC Converter** or **Power Park Module** to supply the maximum lagging **Reactive Power** at **Rated MW** when the **Grid Entry Point** or **User System Entry Point** if **Embedded** voltage is at 105% of nominal.

(ii) a load flow simulation study result to demonstrate the capability of the **Synchronous Generating Unit, DC Converter** or **Power Park Module** to supply the required maximum leading **Reactive Power** at **Rated MW** when the **Grid Entry Point** or **User System Entry Point** voltage if **Embedded** is at 95% of nominal.

CC.A.8.3.2 In the case of a **Power Park Module** where the load flow simulation studies show that the individual **Power Park Units** deviate from nominal voltage to meet the **Reactive Power** requirements then evidence must be provided from factory (e.g. in a **Manufacturer's Data & Performance Report**) or site testing that the **Power Park Unit** is capable of operating continuously at the operating points determined in the load flow simulation studies.

Voltage Control and Reactive Power Stability

CC.A.8.4.1 In the case of a power station containing **Power Park Modules** the **Generator** shall provide a report to demonstrate the dynamic capability and control stability of the **Power Park Module**. The report shall contain:

(i) a dynamic time series simulation study result of a sufficiently large negative step in **System** voltage to cause a change in **Reactive Power** from zero to the maximum lagging value at **Rated MW**.

(ii) a dynamic time series simulation study result of a sufficiently large positive step in **System** voltage to cause a change in **Reactive Power** from zero to the maximum leading value at **Rated MW**.

(iii) a dynamic time series simulation study result to demonstrate control stability at the lagging **Reactive Power** limit by application of a -2%

voltage step while operating within 5% of the lagging **Reactive Power** limit.

(iv) a dynamic time series simulation study result to demonstrate control stability at the leading **Reactive Power** limit by application of a +2% voltage step while operating within 5% of the leading **Reactive Power** limit.

CC.A.8.4.2 All the above studies should be completed with a nominal network voltage for zero **Reactive Power** transfer at the **Grid Entry Point** or **User System Entry Point** if **Embedded** unless stated otherwise and the fault level at the HV connection point at minimum as agreed with **NGET**.

CC.A.8.4.3 **NGET** may permit relaxation from the requirements of CC.A.8.4.1 (i) and (ii) for voltage control if the **Power Park Modules** are comprised of **Power Park Units** in respect of which the **User** has in its submissions to **NGET** referenced an appropriate **Manufacturer's Data & Performance Report** which is acceptable to **NGET** for voltage control.

CC.A.8.4.4 In addition **NGET** may permit a further relaxation from the requirements of CC.A.8.4.1 (iii) and (iv) if the **User** has in its submissions to **NGET** referenced an appropriate **Manufacturer's Data & Performance Report** for a **Power Park Module** mathematical model for voltage control acceptable to **NGET**.

Fault Ride Through

CC.A.8.5.1 The **Generator** or **DC Converter Station** owner shall supply time series simulation study results to demonstrate the capability of **Non-Synchronous Generating Units, DC Converters,** and **Power Park Modules** to meet CC.6.3.15 by submission of a report containing:

(i) a time series simulation study of a 140ms solid three phase short circuit fault applied on the nearest point of the **GB Transmission System** operating at **Supergrid voltage to the Non-Synchronous Generating Unit, DC Converter,** or **Power Park Module**.

(ii) time series simulation study of 140ms unbalanced short circuit faults applied on the nearest point of the **GB Transmission System** operating at **Supergrid** voltage to the **Non-Synchronous Generating Unit, DC Converter**, or **Power Park Module**. The unbalanced faults to be simulated are:

1. a phase to phase fault
2. a two phase to earth fault
3. a single phase to earth fault.

For a **Non-Synchronous Generating Unit, DC Converter or Power Park Module** the simulation study should be completed with the **Non-Synchronous Generating Unit, DC Converter or Power Park Module** operating at full **Active Power** and maximum leading condition and the

fault level at the **Supergrid** HV connection point at minimum or as otherwise agreed with **NGET**.

(iii) time series simulation studies of balanced **Supergrid** voltage dips applied on the nearest point of the **GB Transmission System** operating at **Supergrid** voltage to the **Non-Synchronous Generating Unit, DC Converter** or **Power Park Module**. The simulation studies should include:

1. 30% retained voltage lasting 0.384 seconds
2. 50% retained voltage lasting 0.71 seconds
3. 80% retained voltage lasting 2.5 seconds
4. 85% retained voltage lasting 180 seconds.

For a **Non-Synchronous Generating Unit, DC Converter** or **Power Park Module** the simulation study should be completed with the **Non-Synchronous Generating Unit, DC Converter** or **Power Park Module** operating at full **Active Power** and zero **Reactive Power** output and the fault level at the **Supergrid** HV connection point at minimum or as otherwise agreed with **NGET**. Where the **Non-Synchronous Generating Unit, DC Converter** or **Power Park Module** is **Embedded** the minimum **Network Operator's System** impedance to the **Supergrid** HV connection point shall be used which may be calculated from the maximum fault level at the **User System Entry Point**.

For **DC Converters** the simulations should include the duration of each voltage dip 1 to 4 above for which the **DC Converter** will remain connected.

CC.A.8.5.2 In the case of **Power Park Modules** comprised of **Power Park Units** in respect of which the **User's** reference to a **Manufacturer's Data & Performance Report** has been accepted by **NGET** for Fault Ride Through, CC.A.8.5.1 will not apply provided:

(i) the **Generator** or **DC Converter Station** owner demonstrates by load flow simulation study result that the faults and voltage dips at either side of the **Power Park Unit** transformer corresponding to the required faults and voltage dips in CC.A.8.5.1 applied at the nearest point of the **GB Transmission System** operating at **Supergrid** voltage are less than those included in the **Manufacturer's Data & Performance Report**,

or;

(ii) the same or greater percentage faults and voltage dips in CC.A.8.5.1 have been applied at either side of the **Power Park Unit** transformer in the **Manufacturer's Data & Performance Report**.

Load Rejection

CC.A.8.6.1 In respect of **Generating Units** or **DC Converters** with a **Completion Date** on or after 1 January 2012, the **Generator** or **DC Converter Station**

owner shall demonstrate the speed control performance of the plant under an instantaneous load reduction from full load to **Designed Minimum Operating Level** as required by CC.6.3.7 (c)(i), through simulation study. For **Power Park Modules** comprised of **Power Park Units** having a corresponding generically verified and validated model included in the **Manufacturer's Data & Performance Report** this study is not required if the correct **Manufacturer's Data & Performance Report** reference has been submitted in the appropriate location in the **Data Registration Code**.

CC.A.8.6.2 The simulation study should comprise of a **Generating Unit**, **DC Converter** or **Power Park Module** connected to the total **System** with a local load shown as "X" in figure CC.A.8.6.1. The load "X" represents the auxiliary load of the power station together with a small portion of the **System** to which the **Generating Unit**, **DC Converter** or **Power Park Module** is attached. The value of "X" should be equal to the **Designed Minimum Operating Level** of the **Generating Unit**, **DC Converter** or **Power Park Module** and shall not be greater than 55% of **Registered Capacity** for **Power Stations** with a completion date after 1 January 2001.

CC.A.8.6.3 At the start of the simulation study the **Generating Unit**, **DC Converter** or **Power Park Module** will be operating maximum **Active Power** output. The **Generating Unit**, **DC Converter** or **Power Park Module** will then be islanded from the **Total System** but still supplying load "X" by the opening of a breaker, which is not the Generating Unit, **DC Converter** or **Power Park Module** connection circuit breaker (the governor should therefore, not receive any signals that the breaker has opened other than the reduction in load and subsequent increase in speed). A schematic arrangement of the simulation study is illustrated by Figure CC.A.8.6.1.

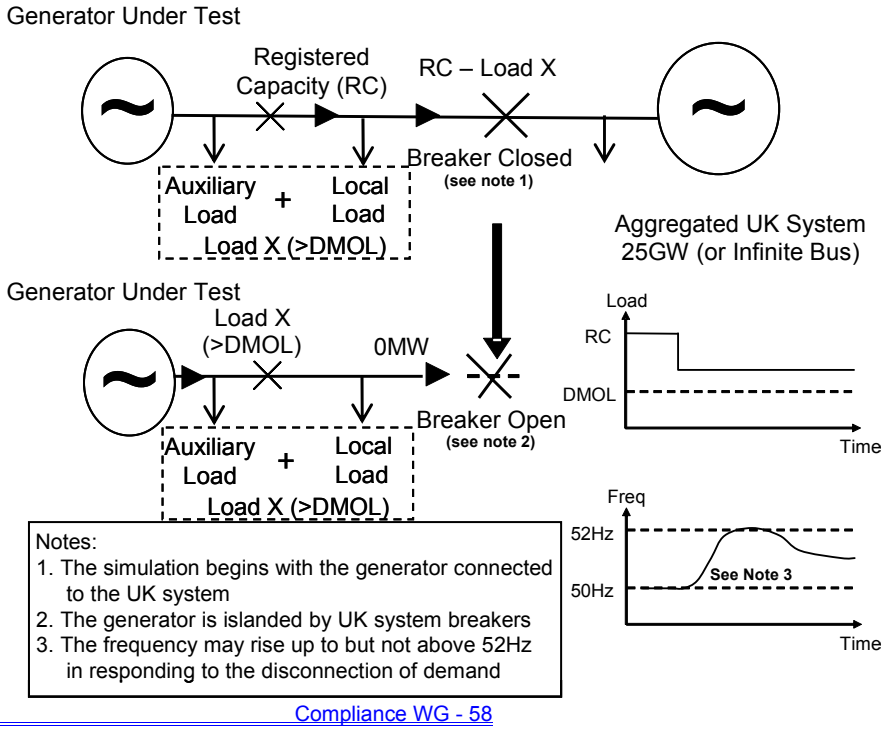


Figure CC.A.8.6.1 – Diagram of Load Rejection Study

CC.A.8.6.4 The study should demonstrate the minimum value of the local load (Load X in Figure CC.A.8.6.1) for which the governor can control the **Frequency** to a maximum of 52Hz is equal to **Designed Minimum Operating Level** or less.

CC.A.8.6.5 Simulation study shall be performed for both control modes, **Frequency Sensitive Mode** (FSM) and **Limited Frequency Sensitive Mode** (LFSM). The simulation study results should indicate **Active Power** and **Frequency** in the island system that includes the **Generating Unit**, **DC Converter** or **Power Park Module**.

CC.A.8.6.6 To validate the model used to simulate load rejection in accordance with CC.6.3.7(c)(i) as described a further simulation study is required to represent the largest positive **Frequency** injection step or fast ramp (BC1 and BC3 of Figure 2) as described in CC.A.13.8 and CC.A.14.6.

Voltage and **Frequency** Controller Model Verification and Validation

CC.A.8.7.1 For **Generating Units, DC Converters or Power Park Modules** with a **Completion Date** after 1 January 2009 or subject to a **Modification** to a **Excitation System**, voltage control system, governor control system or **Frequency** control system after 1 January 2009 the **Generator or DC Converter Station** owner shall provide simulation studies to verify that the proposed controller models supplied to **NGET** under the **Planning Code** are fit for purpose. These simulation study results shall be provided in the timescales stated in the **Planning Code**. For **Power Park Modules** comprised of **Power Park Units** having a corresponding generically verified and validated model in a **Manufacturer's Data & Performance Report NGET** may permit the simulation studies detailed in CC.A.8.7.2, CC.A.8.7.4 and CC.A.8.7.5 to be replaced by submission of the correct **Manufacturer's Data & Performance Report** reference in the appropriate location in the **Data Registration Code**.

CC.A.8.7.2 To demonstrate the **Frequency** control or governor model the **Generator** or **DC Converter Station** owner shall submit a simulation study representing the response of the **Synchronous Generating Unit, DC Converter** or **Power Park Module** operating at 80% of **Registered Capacity**. The simulation study event shall be equivalent to:

(i) a ramped reduction in the measured **System Frequency** of 0.5Hz in 10 seconds followed by
(ii) 20 seconds of steady state with the measured **System Frequency** depressed by 0.5Hz followed by
(iii) a ramped increase in measured **System Frequency** of 0.3Hz over 30 seconds followed by
(iv) 60 seconds of steady state with the measured **System Frequency** depressed by 0.2Hz.

The simulation study shall show **Active Power** output (MW) and the equivalent of **Frequency** injected.

CC.A.8.7.3 To demonstrate the **Excitation System** model the **Generator** shall submit simulation studies representing the response of the **Synchronous Generating Unit** as follows:

(i) operating open circuit at rated terminal voltage and subjected to a 2% step increase in terminal voltage reference.

(ii) operating **Rated MW**, nominal terminal voltage and unity power factor subjected to a 2% step increase in the voltage reference. Where a **Power System Stabiliser** is included within the **Excitation System** this shall be in service.

The simulation study shall show the terminal voltage, field voltage of the **Generating Unit**, **Active Power**, **Reactive Power** and **Power System Stabiliser** output signal as appropriate.

CC.A.8.7.4 To demonstrate the Voltage Controller model the **Generator** or **DC Converter Station** owner shall submit a simulation study representing the response of the **Non-Synchronous Generating Unit, DC Converter** or **Power Park Module** operating at **Rated MW** and unity power factor at the connection point to a 2% step increase in the voltage reference. The simulation study shall show the terminal voltage, **Active Power**, **Reactive Power** and **Power System Stabiliser** output signal as appropriate.

CC.A.8.7.5 To validate that the excitation and voltage control models submitted under the **Planning Code** are a reasonable representation of the dynamic behaviour of the **Synchronous Generating Unit, DC Converter Station** or **Power Park Module** as built, the **Generator** or **DC Converter Station** owner shall repeat the simulation studies outlined above but using the operating conditions of the equivalent tests. The simulation study results shall be displayed overlaid on the actual test results.

CC.A.8.7.6 To validate that the **Frequency** control model submitted under the **Planning Code** is a reasonable representation of the dynamic behaviour of the **Power Park Module** as built, the **Generator** shall repeat the simulation studies outlined above but using the operating conditions of the equivalent tests. The simulation study results shall be displayed overlaid on the actual test results.

CC.A.8.7.7 For **Generating Units** or **DC Converters** with a **Completion Date** after 1 January 2012 or subject to a **Modification** to the governor system or **Frequency** control system after 1 January 2012 to validate that the governor or **Frequency** control models submitted under the **Planning Code** is a reasonable representation of the dynamic behaviour of the **Synchronous Generating Unit** or **DC Converter Station** as built, the **Generator** or **DC Converter Station** owner shall repeat the simulation studies outlined above but using the operating conditions of the equivalent tests. The simulation study results shall be displayed overlaid on the actual test results.

Sub-synchronous Resonance control and Power Oscillation Damping control for **DC Converters**

CC.A.8.8.1 To demonstrate the compliance of the sub-synchronous control function with CC6.3.16(a) and the terms of the **Bilateral Agreement** the **DC Converter Station** owner shall submit a simulation study report

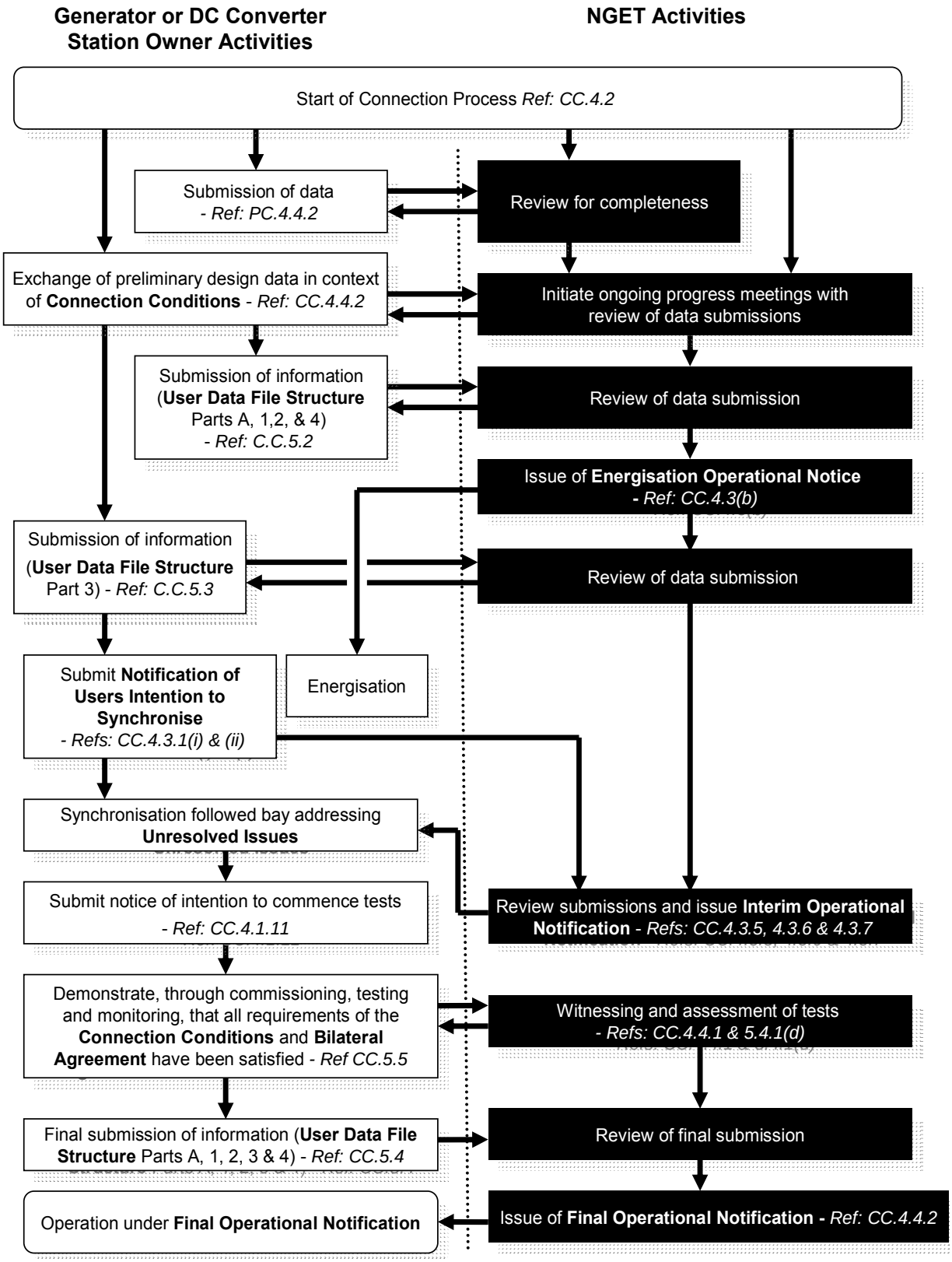
CC.A.8.8.2 Where power oscillation damping control function is specified on a **DC Converter** the **DC Converter Station** owner shall submit a simulation study report to demonstrate the compliance with CC6.3.16(b) and the terms of the **Bilateral Agreement.**

CC.A.8.8.3 The simulation studies should utilise the **DC Converter** control system models including the settings as required under the **Planning Code** (PC.A.5.3.2). The network conditions for the above simulation studies should be discussed with **NGET** prior to commencing any simulation studies.

4. Insert a new Appendix 9 to the CCs:

APPENDIX CC.A.9

Illustrative Compliance Process (Process 1) for New Power Stations/DC Converter Stations



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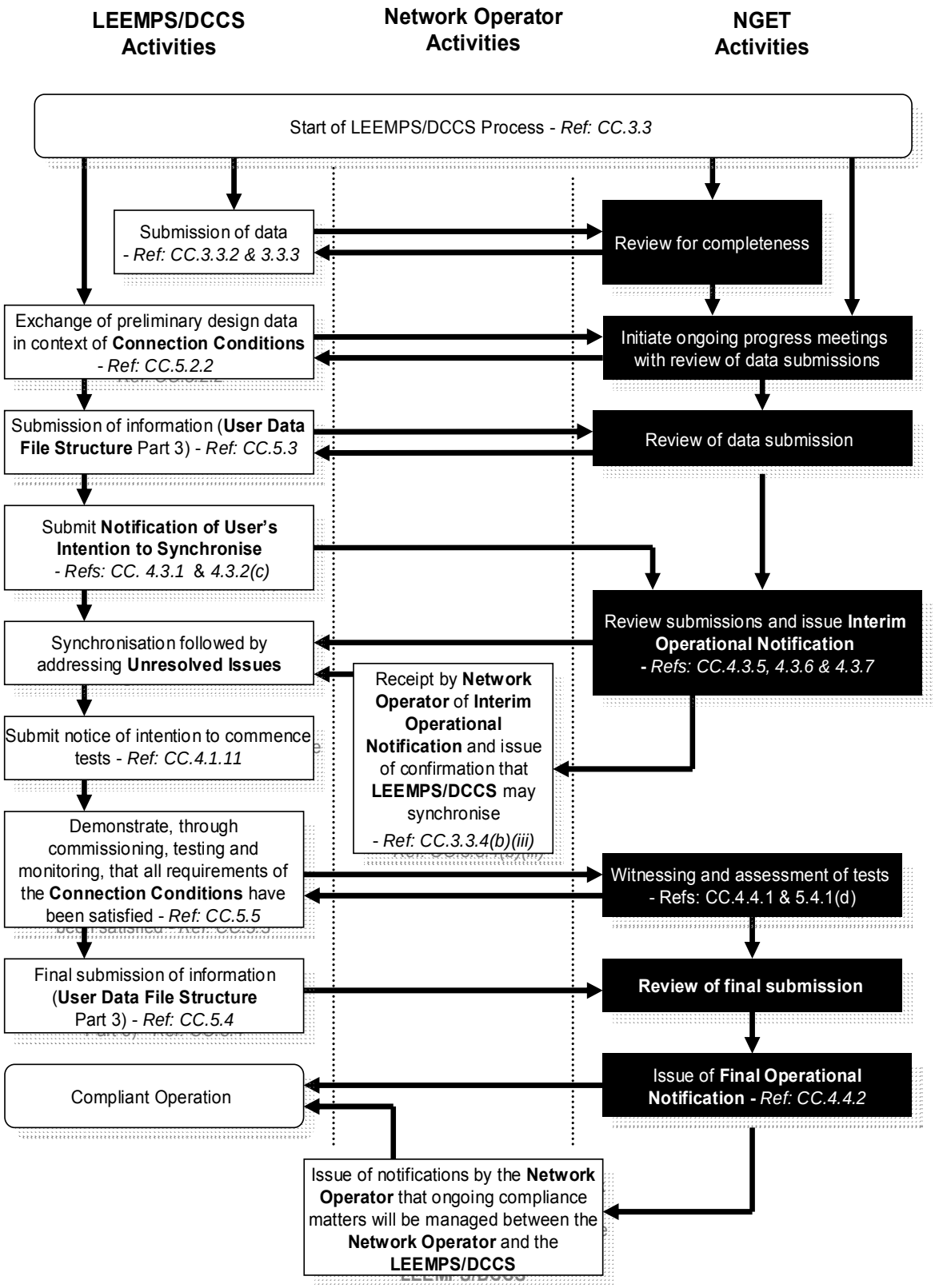
5. Insert a new Appendix 10 to the CCs:

APPENDIX CC.A.10

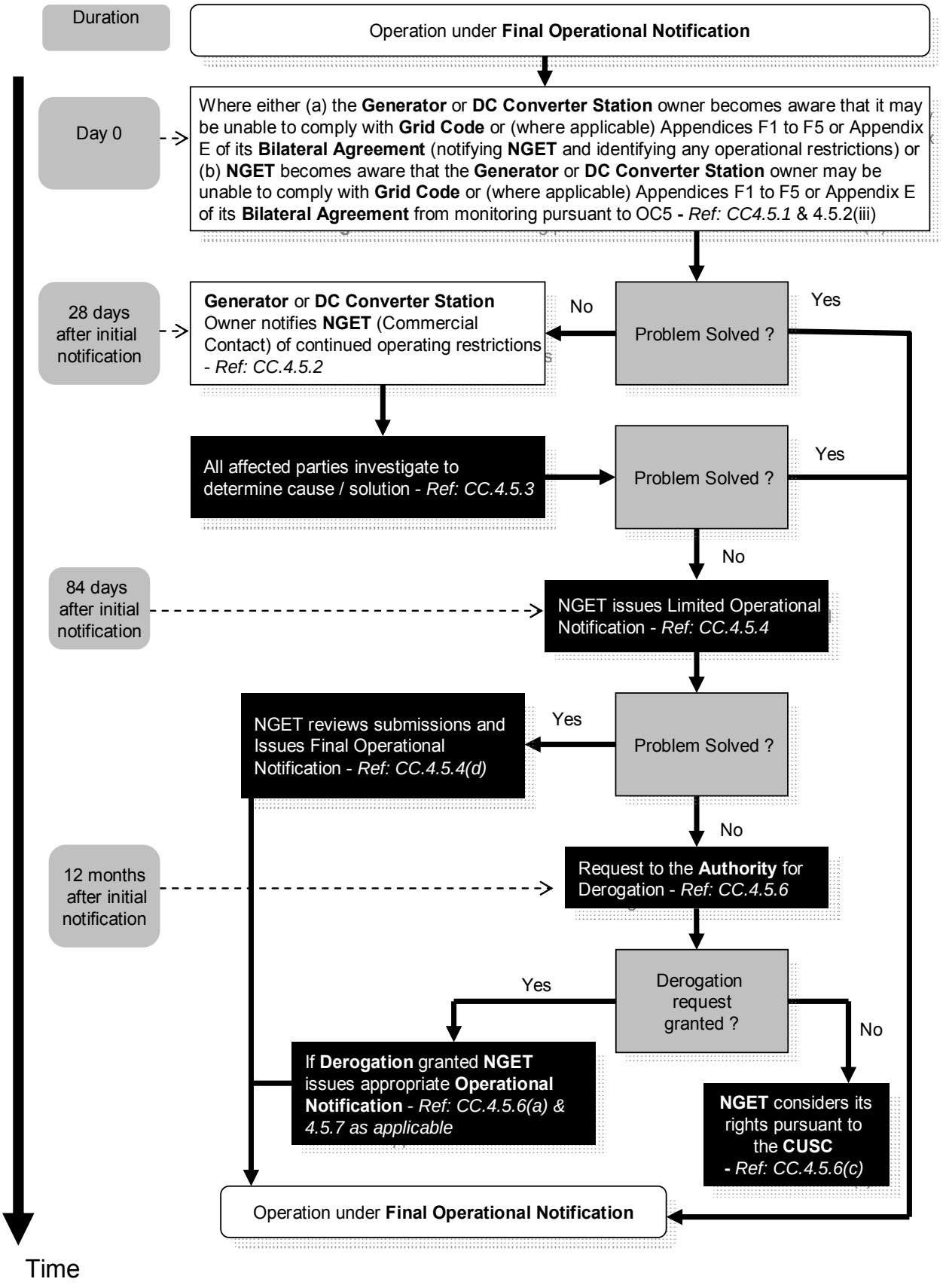
Compliance Process for LEEMPS/DCCS

Process 2 NGET option for compliance in accordance with CC.3.3.4(b).



6. Insert a new Appendix 11 to the CCs:

APPENDIX CC.A.11 **Compliance Process (Process 3) for Ongoing Compliance**


Duration
Operation under **Final Operational Notification**
Day 0
Where either (a) the **Generator** or **DC Converter Station** owner becomes aware that it may be unable to comply with **Grid Code** or (where applicable) Appendices F1 to F5 or Appendix E of its **Bilateral Agreement** (notifying **NGET** and identifying any operational restrictions) or (b) **NGET** becomes aware that the **Generator** or **DC Converter Station** owner may be unable to comply with **Grid Code** or (where applicable) Appendices F1 to F5 or Appendix E of its **Bilateral Agreement** from monitoring pursuant to OC5 **-** *Ref: CC4.5.1* & 4.5.2(iii)
28 days after initial notification
Generator or **DC Converter Station** Owner notifies **NGET** (Commercial Contact) of continued operating restrictions - *Ref: CC.4.5.2*
No
Problem Solved ?
Yes
All affected parties investigate to determine cause / solution - *Ref: CC.4.5.3*
Problem Solved ?
Yes
No
84 days after initial notification
NGET issues Limited Operational Notification - *Ref: CC.4.5.4*
NGET reviews submissions and Issues Final Operational Notification - *Ref: CC.4.5.4(d)*
Yes
Problem Solved ?
No
12 months after initial notification
Request to the **Authority** for Derogation - *Ref: CC.4.5.6*
Derogation request granted ?
Yes
No
If **Derogation** granted **NGET** issues appropriate **Operational Notification** - *Ref: CC.4.5.6(a) & 4.5.7 as applicable*
NGET considers its rights pursuant to the **CUSC** **-** *Ref: CC.4.5.6(c)*
Operation under **Final Operational Notification**
Time

7. Insert a new Appendix 12 to the CCs:

CC.A.12

USER SELF CERTIFICATION OF COMPLIANCE (Interim/Final)

Power Station/ DC Converter Station	[Name of Connection Site/site of connection]	**User:**	[Full User name]	**Registered Capacity (MW) of Plant:**	

This **User Self Certification of Compliance** records the compliance by the **User** in respect of [NAME] **Power Station/DC Converter Station** with the **Grid Code** [or in the case of **LEEMPS/DCCS** those provisions of the **Grid Code** with which the **Distribution Code** requires the **LEEMPS/DCCS** to comply] and the requirements of the **Bilateral Agreement** and **Construction Agreement** dated [ ] with reference number [ ]. It is completed by the **Power Station/DC Converter Station** owner in the case of **Plant** and/or **Apparatus** connected to the **GB Transmission System** and for **Embedded Plant**. For **LEEMPS/DCCS** a **User Self Certification of Compliance** shall also be completed and submitted by the **Network Operator** where CC.3.3.4(a) applies.

We have recorded our compliance against each requirement of the **Grid Code** which applies to the **Power Station/DC Converter Station**, together with references to supporting evidence and a commentary where this is appropriate, and have provided this to **NGET**. A copy of the **Compliance Statement** is attached.

Supporting evidence, in the form of simulation results, test results, manufacturer's data and other documentation, is attached in the **User Data File Structure**.

The **User** hereby certifies that, to the best of its knowledge and acting in accordance with **Good Industry Practice**, the **Power Station** is compliant with the **Grid Code** and the **Bilateral Agreement** in all aspects [with the following **Unresolved Issues***] [with the following derogation(s)**]:

Connection Condition	**Requirement**	**Ref:**	**Issue**

Compliance certified by:	Name: [PERSON]	Title: [PERSON DESIGNATION]
	Signature: [PERSON]	Of [User details]
	Date:	

* Include for Interim User Self Certification of Compliance ahead of Interim Operational Notification.

** Include for final User Self Certification of Compliance ahead of Final Operational Notification where derogation(s) have been granted. If no derogation(s) required delete wording and Table.

……

……

8. Insert a new Appendix 13 to the CCs:

Appendix 13

Compliance Testing for Synchronous Plant

CC.A.13.1 SCOPE

CC.A.13.1.1 This Appendix sets out the tests contained therein to demonstrate compliance with the relevant clauses of the Connection Conditions of the **Grid Code**. This Appendix shall be read in conjunction with CC.4 and CC.5 with regard to the submission of the reports to **NGET**.

CC.A.13.1.2 The tests specified in this Appendix will normally be sufficient to demonstrate compliance however **NGET** may:

(i) agree an alternative set of tests provided **NGET** 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 **NGET** 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.**

CC.A.13.1.3 The **Generator or DC Converter Station** is responsible for carrying out the tests set out in and in accordance with this Appendix and the **Generator or DC Converter Station** retains the responsibility for the safety of personnel and plant during the test. **NGET** will witness all of the tests outlined or agreed in relation to this Appendix unless **NGET** decides and notifies the **Generator or DC Converter Station** otherwise. Reactive Capability tests may by witnessed by **NGET** remotely from the **NGET** control centre. For all on site **NGET** witnessed tests the **Generator or DC Converter Station** should ensure suitable representatives from the **Generator or DC Converter Station** and manufacturer (if appropriate) are available on site for the entire testing period. In all cases the **Generator or DC Converter Station** shall provide suitable monitoring equipment to record all relevant test signals as outlined below in CC.A.14.1.5.

CC.A.13.1.4 The signals which shall be provided by the **Generator or DC Converter Station** to **NGET** for onsite monitoring shall be of the following resolution, unless otherwise agreed by **NGET**:

(i) 1 Hz for reactive range tests

(ii) 10 Hz for frequency control tests

(iii) 100 Hz for voltage control tests

CC.A.13.1.5 Unless otherwise agreed for on site **NGET** witnessed tests **NGET** will require connection of monitoring equipment in addition to that of the **Generator's or DC Converter Station's**. The **Generator or DC Converter Station** will provide all relevant signals for this purpose in the form of d.c. voltages within the range -10V to +10V. In exceptional circumstances some signals may be accepted as d.c. voltages within the range -60V to +60V with prior agreement between the **Generator or DC Converter Station** and **NGET**. All signals shall be suitably scaled across the range. The following scaling would (unless **NGET** notify the **Generator or DC Converter Station** otherwise) be acceptable to **NGET**:

(a) 0MW to **Registered Capacity** 0-8Vdc
(b) Maximum leading **Reactive Power** to maximum lagging **Reactive Power** -8 to 8 Vdc
(c) 48 – 52Hz as -8 to 8Vdc
(d) Nominal voltage -10% to +10% as -8 to 8Vdc

The **Generator or DC Converter Station** shall provide to **NGET** a 230V power supply adjacent to the signal terminal location.

CC.A.13.1.6 The **Generator or DC Converter Station** shall submit a schedule of tests to **NGET** in accordance with CC.4.3.1

CC.A.13.1.7 Prior to the testing of a **Generating Unit** the **Generator or DC Converter Station** shall complete the **Integral Equipment Test** procedure in accordance with OC.7.5

*CC.A.13.2 **Excitation System** Open Circuit Step Response Tests*

(a) Description & Purpose of Test:

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.

The test shall be carried out prior to synchronisation in accordance with CC.4.3.4.

This is not witnessed by **NGET** unless specifically requested by **NGET**.

(b) Results Required:

Vt - **Generating Unit** terminal voltage
Efd - **Generating Unit** field voltage or main exciter field voltage
Ifd- **Generating Unit** field current (where possible)
Step injection signal

Results shall be supplied to **NGET** in an electronic spreadsheet format.

(c) Test Assessment:

Test results will be assessed by **NGET** against CC.A.6.2.4.1.

CC.A.13.3 Open & Short Circuit Saturation Characteristics

(a) Description & Purpose of Test:

The test shall normally be carried out prior to synchronisation in accordance with CC.4.3.4. Manufacturer factory test results may be used where appropriate.

This is not witnessed by **NGET**.

(b) Results Required:

Graphical and tabular representations in an electronic format showing per unit open circuit terminal voltage and short circuit current versus per unit field current.

(c) Test Assessment:

Test results will be assessed by **NGET** against CC.6.3.2(a)

CC.A.13.4 **Excitation System** On-Load Tests

(a) Description & Purpose of Test:

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.

Where a **Power System Stabiliser** is present:

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.

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 **NGET** (up to rated MVA output).

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.

The interaction of the **PSS** with changes in **Active Power** shall be tested by application of a +0.5Hz frequency injection to the governor.

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.

Where the **Bilateral Agreement** requires that the **PSS** is in service at a specified loading level additional testing witnessed by **NGET** will be required during the commissioning process before the **Generating Unit** or **CCGT Module** may exceed this output level.

Where the **Excitation System** includes a **PSS**, the **Generator or DC Converter Station** shall provide a suitable noise source to facilitate noise injection testing.

A typical procedure is shown in CC.A.13.4 (d)

(b) Results Required:

MW - **Active Power** at **Generating Unit** terminals
MVAr - **Reactive Power** at **Generating Unit** terminals
Vt - **Generating Unit** terminal voltage
Efd- **Generating Unit** field voltage and/or main exciter field voltage
PSS output, where applicable.

(c) Test Assessment:

Test results will be assessed by **NGET** against:

• CC.6.3.6(b), CC.6.3.8, CC.A.6.2.4.2, CC.A.6.2.5 and CC.A.6.2.6 of the **Grid Code** and the **Bilateral Agreement**.

(d) Typical Procedure:

The following typical procedure is provided to assist **Generator's or DC Converter Station's** in drawing up their own site specific procedures for the **NGET** witnessed **PSS** Tests.

CC.A.13.5 **Under-excitation Limiter Performance**

(a) Description & Purpose of Test:

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.

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 **NGET** under OC2.

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.

The **Under-excitation Limiter** will normally be tested at low **Active Power** output and at maximum **Active Power** output (**Registered Capacity**).

A typical procedure is shown in CC.A.13.5(d)

(b) Results Required:

MW - **Active Power** at **Generating Unit** terminals
MVAr - **Reactive Power** at **Generating Unit** terminals
Vt - **Generating Unit** terminal voltage
Efd - **Generating Unit** field voltage and/or main exciter field voltage
Ifd – **Generating Unit** Field current if available

.

(c) Test Assessment:

Test results will be assessed by **NGET** against:
• CC.6.3.8, and CC.A.6.2.7.2

(d) Typical Test Procedure:

The following typical procedure is provided to assist **Generator's or DC Converter Station's** in drawing up their own site specific procedures for the **NGET** witnessed **Under-excitation Limiter** Tests.

Step No	Test	Injection	Notes
		Synchronous generator running MEL at unity power factor. UEL limit temporarily moved close to the operating point of the generator	
1 2 3	1	• **PSS** on Inject • Inject -2% voltage step into AVR voltage reference and hold at least for 10 seconds • Remove step returning AVR Voltage Reference to nominal and hold for at least 10 seconds	
		UEL limit moved to normal position. Synchronous generator running at MEL and at leading MVArs close to UEL limit	
4 5 6	2	• **PSS** on • Inject -2% voltage step into AVR voltage reference and hold at least for 10 seconds • Remove step returning AVR Voltage Reference to nominal and hold for at least 10 seconds	

*CC.A.13.6 **Over-excitation Limiter Performance***

(a) Description & Purpose of Test:

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 **NGET** and the **Generator or DC Converter Station**. 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.

A typical procedure is shown in CC.A.13.6(d).

(b) Results Required:

MW – **Active Power** at **Generating Unit** terminals
MVAr – **Reactive Power** at **Generating Unit** terminals
Vt – **Generating Unit** terminal voltage
Efd – **Generating Unit** field voltage and/or main exciter field voltage
Ifd – Generating Unit field current if available

Results shall be legible, identifiable by labelling, and shall have appropriate scaling.

(c) Test Assessment:

Test results will be assessed by **NGET** against:
CC.6.3.6(b), CC.6.3.8 and CC.A.6.2.8.2

(d) Typical Procedure:

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.

Step No	Test	Injection	Notes
		Synchronous Generator running rated MW and maximum lagging MVAr	
1		OEL temporarily set close to this operating point. **PSS** on.	
2 3 4	1	• Inject positive voltage step into AVR voltage reference and hold • Wait till OEL operates after sufficient time delay to bring back the excitation back to the limit • Remove step returning AVR Voltage Reference to nominal	
5		OEL restored to its normal operating value. **PSS** on.	

CC.A.13.7 Reactive Capability

(a) Description & Purpose of Test:

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.

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.

The test procedure, time and date will be agreed with **NGET** and will be to the instruction of **NGET** control centre and shall be monitored and recorded at both the **NGET** control centre and by the **Generator or DC Converter Station**.

(b) Results Required:

MW - **Active Power** at **Generating Unit** terminals
MVAr - **Reactive Power** at **Generating Unit** terminals
Vt - **Generating Unit** terminal voltage
Generator transformer tap position
Voltage at the higher voltage side of generator transformer if available
Ambient conditions (temperature and pressure)

Results shall be supplied in an electronic spreadsheet format

(c) Test Assessment:

Test results will be assessed by **NGET** against:

• CC.6.3.2, CC.6.3.4 and OC.5.5.3.

CC A.13.8 Governor and Load Controller Response Performance

(a) Description & Purpose of Test:

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.

Prior to witnessing the governor tests set out in CC.A.13.8 (e), **NGET** requires the **Generator or DC Converter Station** to conduct the preliminary tests detailed in CC.A.13.8 (d) and send the results to **NGET** for assessment unless agreed otherwise by **NGET**. 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.

Where **CCGT module** or **Generating Unit** is capable of operating on alternative fuels, tests will be required to demonstrate performance when operating on each fuel. **NGET** may agree a reduction from the tests listed in CC.A.13.8 (e) for demonstrating performance on the alternative fuel. This includes the case where a main fuel is supplemented by bio-fuel.

(b) Results Required:

Test signal schedules for different plant types:

All plant
System Frequency
Injected Speed Reference
Active Power Output
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 the following signals may be supplied at 1Hz
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 Electric Plant
Speed Governor Demand Signal
Actuator Output Signal
Guide Vane / Needle Valve Position

NGET and the **Generator** may agree to variations on the list of signals to be provided to suit the control system.

(c) Test Assessment

Test results will be assessed by **NGET** against:

• CC.6.3.6(a), CC.6.3.7, CC.8.1, **Ancillary Service Agreement,** CC.A.3,.
• BC3.5, BC3.6, BC3.7,

(d) Preliminary Governor Frequency Response Testing

Prior to conducting the full set of tests as per CC.A.13.8 (e), **Generator's or DC Converter Station's** 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	Frequency Injection	Notes
14	• Inject - 0.5Hz frequency fall over 10 sec • Hold until conditions stabilise • Remove the injected signal	
13	• Inject +0.5Hz frequency rise over 10 sec • Hold until conditions stabilise • Remove the injected signal	
8	• 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	

The recorded results (e.g. Finj, MW and control signals) should be sampled at a minimum rate of 1 Hz to allow **NGET** to assess the plant performance from the initial transients (seconds) to the final steady state conditions (5-15 minutes depending on the plant design).

(f) Frequency Response Testing Schedule Witnessed by **NGET**

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 **NGET**.

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	65% MEL
Module Load Point 2 (**Minimum Generation**)	MG
Module Load Point 1 (**Design Minimum Operating Level**)	DMOL

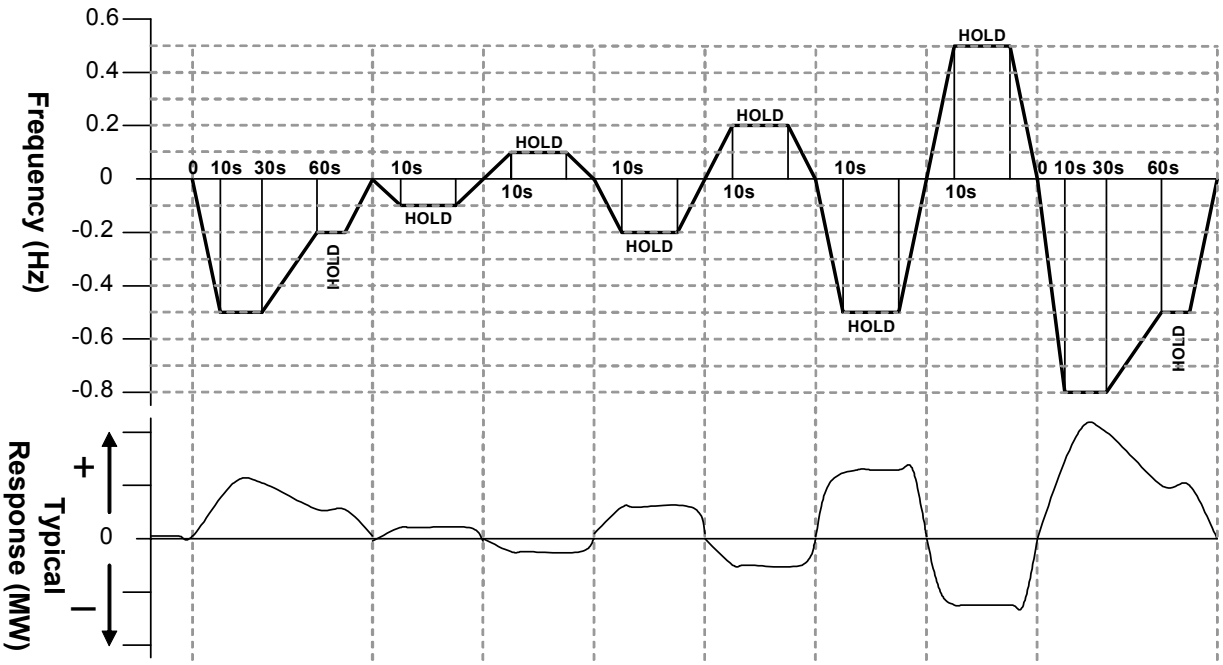
The tests are divided into the following two types:

(i) Frequency response volume tests as per CC.A.13.8. Figure 1. These tests consist of frequency profile and ramp tests.

(ii) System islanding and step response tests as shown by CC.A.13.8. Figure 2.

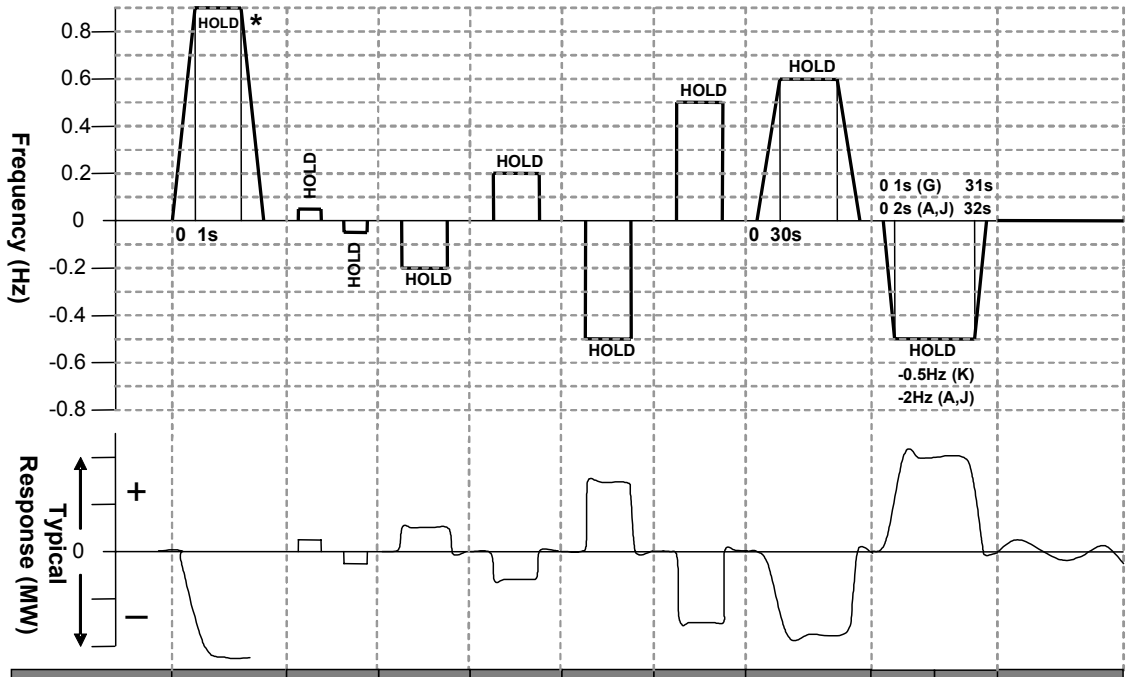
There should be sufficient time allowed between tests for control systems to reach steady state (depending on available power resource). Where the diagram states

'HOLD' the current injection should be maintained until the **Active Power** (MW) output of the **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.. **NGET** may require repeat tests should the tests give unexpected results.



Load Point	LF Event Profile 1	LF Ramp -0.1Hz	HF Ramp +0.1Hz	LF Ramp -0.2Hz	HF Ramp +0.2Hz	LF Ramp -0.5Hz	HF Ramp +0.5Hz	LF Event Profile 2
MLP6			1	2	3		4	
MLP5	5			6			7	
MLP4	8	9	10	11	12	13	14	
MLP3	15						16	17
MLP2	18			19	20	21		22
MLP1	23			24	25			26

Figure 1: Frequency Response Capability Tests



Load Point	+2.0*	±0.02	-0.2	+0.2	-0.5	+0.5	+0.6	-0.5	-2.0	± 0**
MLP6	BC1						BC2			L
MLP6 LFSM	BC3						BC4			
MLP5								A		
MLP4		D/E	F	G	H	I		J		M
MLP4 LFSM										N
MLP3										
MLP2										
MLP1								K		

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)x0.04x50 =	0.9Hz

** 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.

C.C. A.13.9 Compliance with CC.6.3.3

(a) Description & Purpose of Test:

Where the plant design includes active control function or functions to deliver CC.6.3.3 compliance, the **Generator or DC Converter Station** will propose and agree a test procedure with **NGET**, 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).

The **Generator or DC Converter Station** shall inform **NGET** if any load limiter control is additionally employed.

(b) Results Required:

MW - **Active Power** at **Generating Unit** terminals
Fs - **System Frequency**
Tamb- Ambient temperature
Control system parameters as agreed with **NGET**

NGET will agree with the **Generator or DC Converter Station** which additional control system parameters shall be monitored.

Where **NGET** recording equipment is not used results shall be supplied to **NGET** in an electronic spreadsheet format

(c) Test Assessment:

Test results will be assessed by **NGET** against:
• CC.6.3.3

Additional Criterion of assessment:
For variations in **System Frequency** exceeding 0.1Hz within a period of less than 10 seconds, the **Active Power** output is within ±0.2% of the requirements of CC.6.3.3 when monitored at prevailing external air temperature of up to 25˚.

……

9. Insert a new Appendix 14 to the CCs:

Appendix 14

Compliance Testing for **Power Park Modules**

CC.A.14.1.1 This Appendix outlines the general testing requirements for **Power Park Modules** to demonstrate compliance with the relevant aspects of the **Grid Code**, **Ancillary Services Agreement** and **Bilateral Agreement**. The tests specified in this Appendix will normally be sufficient to demonstrate compliance however **NGET** may:

(i) agree an alternative set of tests provided **NGET** 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 **NGET** 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 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 **NGET**; and/or

(v) agree a reduced set of tests for subsequent **Power Park Modules** following successful completion of the first **Power Park Module** tests in the case of a **Power Station** comprised of two or more **Power Park Modules** which **NGET** reasonably considers to be identical.

If:

(a) the tests performed pursuant to CC.A.14.1.1(iv) do not replicate the results contained in the **Manufacturer's Data & Performance Report** or

(b) the tests performed pursuant to CC.A.14.1.1(v) in respect of subsequent **Power Park Modules** do not replicate the full tests for the first **Power Park Module**, or

(c) any of the tests performed pursuant to CC.A.14.1.1(iv) or CC.A.14.1.1(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.

CC.A.14.1.2 The **Generator or DC Converter Station** is responsible for carrying out the tests set out in and in accordance with this Appendix and the

Generator or DC Converter Station retains the responsibility for the safety of personnel and plant during the test. **NGET** will witness all of the tests outlined or agreed in relation to this Appendix unless **NGET** decides and notifies the **Generator or DC Converter Station** otherwise. Reactive Capability tests may by witnessed by **NGET** remotely from the **NGET** control centre. For all on site **NGET** witnessed tests the **Generator or DC Converter Station** must ensure suitable representatives from the **Generator or DC Converter Station** and / or **Power Park Module** manufacturer (if appropriate) are available on site for the entire testing period. In all cases the **Generator or DC Converter Station** shall provide suitable monitoring equipment to record all relevant test signals as outlined below in CC.A.14.1.5.

CC.A.14.1.3 The signals which shall be provided by the **Generator or DC Converter Station** shall be of at least the following resolution:

(iv) 1 Hz for reactive range tests

(v) 10 Hz for frequency control tests

(vi) 100 Hz for voltage control tests

(vii) A suitable frequency rate for fault ride through tests as agreed with **NGET**.

CC.A.14.1.4 Unless otherwise agreed for on site **NGET** witnessed tests **NGET** will connect monitoring equipment in addition to that of the **Generator or DC Converter Station's**. The **Generator or DC Converter Station** should generally provide all relevant signals for this purpose in the form of d.c. voltages within the range -10V to +10V. In exceptional circumstances some signals may be accepted as d.c. voltages within the range -60V to +60V with prior agreement between the **Generator or DC Converter Station** and **NGET**. All signals shall:

(i) in the case of a **Power Park Module** located onshore, be suitably terminated in a single accessible location at the **Generator or DC Converter Station's** site.

(ii) in the case of a **Power Park Module** located offshore, be transmitted onshore without 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 be suitably terminated in a single robust location at or near the **Grid Entry Point** or **Generator or DC Converter Station System Entry Point**.

(iii) in the case of a **Power Park Module** located onshore or offshore, be suitably scaled across the range. The following scaling would (unless **NGET** notify the **Generator or DC Converter Station** otherwise) be acceptable to **NGET**:

(a) 0MW to **Registered Capacity** 0-8Vdc

(b) Maximum leading **Reactive Power** to maximum lagging **Reactive Power** -8 to 8 Vdc
(c) 48 – 52Hz as -8 to 8Vdc
(d) Nominal voltage -10% to +10% as -8 to 8Vdc

The **Generator or DC Converter Station** shall provide to **NGET** a 230V power supply adjacent to the signal terminal location.

CC.A.14.1.5 During any tests, the following signals shall be provided to **NGET** by the **Generator or DC Converter Station** in accordance with CC.A.14.1.3, CC.A.14.1.4 and CC.A.14.1.7:

(i) Total **Power Park Module Active Power** MW

(ii) Total **Power Park Module Reactive Power** MVAr

(iii) **Grid Entry Point** or **Generator or DC Converter Station System Entry Point** line-line Voltage (kV)

(iv) System frequency (Hz)

(v) Injected frequency signal (Hz) or test logic signal (Boolean) when appropriate

(vi) Injected voltage signal or test logic signal when appropriate

(vii) **Power Park Module** site voltage (MV) (kV)

(viii) **Power System Stabiliser** signal (when appropriate)

(ix) Available power for **Power Park Module** (MW)

(x) Power source speed (e.g. wind speed) (m/s) (when appropriate)

(xi) Power source direction (degrees) (when appropriate)

(xii) Any other signals as agreed between the **Generator or DC Converter Station** and **NGET** or as specified in the **Bilateral Agreement**

NGET accept that signals CC.A.14.1.5 (ix), (x) and (xi) may have lower effective sample rates than those required in CC.A.14.1.4 and CC.A.14.1.6 although any signals supplied for connection to **NGET's** recording equipment which do not meet at least the sample rates detailed in CC.A.14.1.4 should have the actual sample rates indicated to **NGET** before testing commences.

CC.A.14.1.6 In addition to the dynamic signals supplied in CC.A.14.1.5 the **Generator or DC Converter Station** shall inform **NGET** 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

CC.A.14.1.7 For all **NGET** witnessed testing the **Generator or DC Converter Station** shall either

(i) provide to **NGET** all signals outlined in CC.A.14.1.5 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.A.14.1.3;

or

(ii) provide signals CC.A.14.1.5 (i) to (iv) direct from one or more transducer(s) connected to current and voltage transformers for monitoring in real time on site, with all signals provided from the **Power Park Module** control systems as a download once the testing has been completed provided that:

(a) the full test results can be provided within 2 working days to **NGET** unless **NGET** agrees otherwise;

(b) all data can be provided with a sample rate in accordance with CC.A.14.1.3; and

(c) the solution does not unreasonably add a significant delay between tests or impede the volume of testing which can take place on the day.

Transducers connected to current and voltage transformers shall meet the following specification

(a) The transducer(s) shall be permanently installed at the **Generator or DC Converter Station's** location 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 have a response time no greater than 50ms to reach 90% of output.

CC.A.14.1.8 The **Generator or DC Converter Station** shall submit a detailed schedule of tests to **NGET** in accordance with CC.4.3.1, detailed in CC.5.3.1(e) and this Appendix.

CC.A.14.1.9 Prior to the testing of a **Power Park Module** the **Generator or DC Converter Station** shall complete the **Integral Equipment Tests** procedure in accordance with OC.7.5

CC.A.14.1.10 Partial **Power Park Module** testing as defined in CC.A.14.2 and CC.A.14.3 is to be completed at the appropriate stage in accordance with CC.4.3.7

CC.A.14.1.11 Full **Power Park Module** testing as required by CC.5.5 is to be completed as defined in CC.A.14.4 through to CC.A.14.7

CC.A.14.2 Pre 20% (or 50MW) Synchronised Power Park Module Tests

CC.A.14.2.1 Description of Test:

Before 20% of the **Power Park Module** (or 50MW if less) has commissioned, either voltage control test CC.A.14.5.3(i) or (ii) must be completed.

CC.A.14.2.2 Test Assessment:

This test will be assessed by **NGET** against the criteria in CC.6.3.6(b), CC.6.3.8 and the **Bilateral Agreement**

CC.A.14.3 For Power Stations with Registered Capacity ≥100MW Pre 70% Synchronised Power Park Module Tests

CC.A.14.3.1 Description of Tests:

Before 70% but with at least 50% of the **Power Park Module** commissioned the following **Limited Frequency Sensitive** tests as detailed in CC.A.14.6.3 must be completed.

(a) BC3
(b) BC4

CC.A.14.3.2 Test Assessment:

This test will be assessed by **NGET** against the assessment criteria in CC.6.3.3, CC.6.3.7(b), CC.6.3.7(c)(i), CC.6.3.9, BC3.5, BC3.6 and BC3.7 of the **Grid Code** and any relevant parts of the **Bilateral Agreement** with respect to operation in **Limited Frequency Sensitive Mode**.

CC.A.14.4 Reactive Capability Test

CC.A.14.4.1 Description Test:

This section details the procedure for demonstrating the reactive capability of 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 85% of **Registered Capacity** of the **Power Park Module**.

The tests shall be performed by modifying the voltage set-point of the voltage control scheme of the **Power Park Module** by the amount necessary to demonstrate the required reactive range. This is to be conducted for the operating points and durations specified in CC.A.14.4.3.

Embedded Generator or DC Converter Stations 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 NGET** 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

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 or DC Converter Station** and **NGET**.

CC.A.14.4.2 Test Assessment:

The test results will be assessed by **NGET** against CC.6.3.2, CC.6.3.4, CC6.3.8(c) and CC.6.3.9 of the **Grid Code** and the **Bilateral Agreement.** The tests will also be assessed against the **Mandatory Service Agreement**.

CC.A.14.4.3 Tests:

(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.

For the avoidance of doubt, 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.**

CC.A.14.5 Voltage Control Tests

CC.A.14.5.1 Description of Tests:

This section details the procedure for conducting voltage control tests on **Power Park Modules**. 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**. **Embedded Generator or DC Converter Stations** 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**.

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.

For steps initiated using network tap changers the **Generator or DC Converter Station** will need to coordinate with the **Network Operator**. The time between transformer taps shall be at least 10 seconds as per CC.A.14.5 Figure 1.

For step injection into the **Power Park Module** voltage reference, steps of ±1% and ±2% shall be applied to the voltage control system reference summing junction. The injection shall be maintained for 10 seconds as per CC.A.14.5 Figure 2.

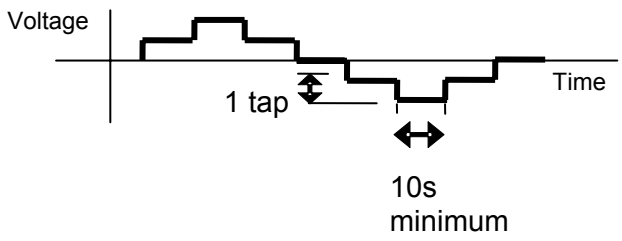
Where the voltage control system comprises of discretely switched plant and apparatus additional tests will be required to demonstrate that its performance is in accordance with **Grid Code** requirements.

CC.A.14.5.2 Test Assessment:

The tests will be assessed by **NGET** against CC.6.3.6(b), CC.6.3.8, CC.A.7 and the **Bilateral Agreement**

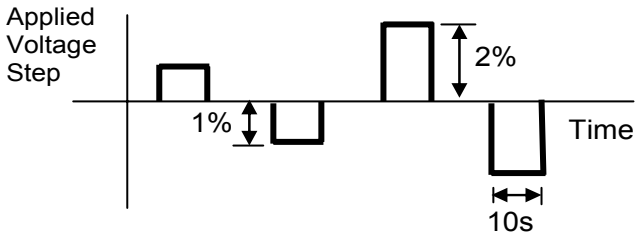
CC.A.14.5.3 Tests:

(i)



CC.A.14.5 Figure 1 – Transformer tap sequence for voltage control tests

(ii)



CC.A.14.5 Figure 2 – Step injection sequence for voltage control tests

CC.A.14.6 Frequency Response Tests

CC.A.14.6.1 Description of Test:

This section describes the procedure for performing frequency response testing. 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**.

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 CC.A.14.6.3 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.

In addition to the frequency response requirements it is necessary to demonstrate the **Power Park Modules** 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 CC.A.14.6.3.

Preliminary Governor Frequency Response Testing

Prior to conducting the full set of tests as per CC.A.14.6.3, **Generator or DC Converter Stations** 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. 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	Frequency / Injection	Notes
14	• Inject – 0.5Hz frequency fall over 10 sec • Hold until conditions stabilise • Remove the injected signal	
13	• Inject + 0.5Hz frequency rise over 10 sec • Hold until conditions stabilise • Remove the injected signal	
8	• 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	

The recorded results (e.g. Finj, MW and control signals) should be sampled at a minimum rate of 1 Hz to allow **NGET** to assess the plant performance from the initial transients (seconds) to the final steady state conditions (5-15 minutes depending on the plant design).

CC.A.14.6.2 Test Assessment:

The test results will be assessed by **NGET** against CC.6.3.3, CC.6.3.6(a), CC.6.3.7, CC.6.3.9, CC.A.3, BC3.5, BC3.6 and BC3.7 of the **Grid Code** and any relevant parts of the **Bilateral Agreement**. The tests will also be assessed against the **Mandatory Service Agreement**.

CC.A.14.6.3 Tests:

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 by CC.A.14.6 Table 1 unless agreed otherwise by **NGET**.

Module Load Points (MLP) For Test		
Module Load Point 6 (Maximum Export Limit, >65% Registered Capacity)	100% MEL	MW (MLP6)
Module Load Point 5	90% MEL	MW (MLP5)
Module Load Point 4 (Mid point of Operating Range)	(MEL + DMOL) / 2	MW (MLP4)
Module Load Point 3	DMOL + 20%	MW (MLP3)
Module Load Point 2	DMOL + 10%	MW (MLP2)
Module Load Point 1 (**Design Minimum Operating Level**)	DMOL	MW (MLP1)

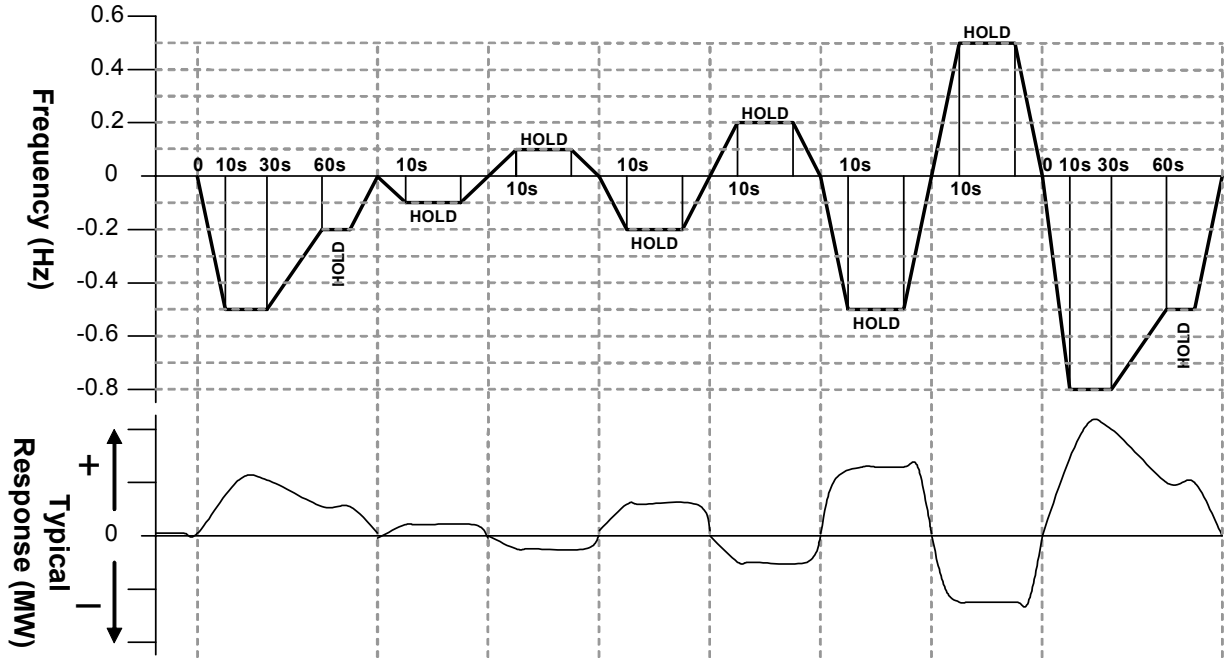
CC.A.14.6 Table 1 – Calculation of load points for frequency response testing

The tests are divided into the following two types:

(i) Frequency response volume tests as per CC.A.14.6. Figure1. These tests consist of frequency profile and ramp tests.

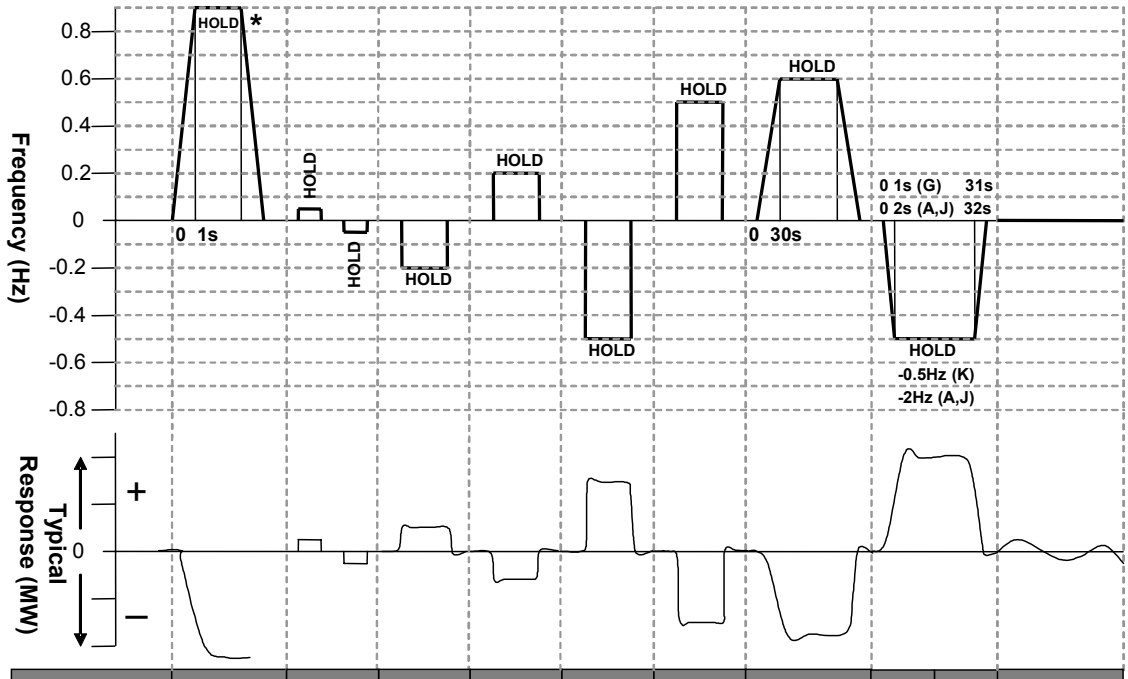
(ii) System islanding and step response tests as shown by CC.A.14.6 Figure 2.

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. **NGET** may require repeat tests should the response volume be affected by the available power, or if tests give unexpected results.



Load Point	LF Event Profile 1	LF Ramp -0.1Hz	HF Ramp +0.1Hz	LF Ramp -0.2Hz	HF Ramp +0.2Hz	LF Ramp -0.5Hz	HF Ramp +0.5Hz	LF Event Profile 2
MLP6			1	2	3		4	
MLP5	5			6			7	
MLP4	8	9	10	11	12	13	14	
MLP3	15						16	17
MLP2	18			19	20	21		22
MLP1	23			24	25			26

CC.A.14.6. Figure 1 – Frequency response volume tests



Load Point	+2.0*	±0.02	-0.2	+0.2	-0.5	+0.5	+0.6	-0.5	-2.0	± 0**
MLP6	BC1						BC2			L
MLP6 LFSM	BC3						BC4			
MLP5								A		
MLP4		D/E	F	G	H	I		J		M
MLP4 LFSM										N
MLP3										
MLP2										
MLP1								K		

CC.A.14.6. 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)x0.04x50 =	0.9Hz

** 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.

CC.A.14.7 Fault Ride Through Test

CC.A.14.7.1 Description Test:

This section describes the procedure for conducting fault ride through tests on a single **Power Park Unit**. The results from this test will be reviewed by **NGET** in conjunction with the requirements in CC.4.4.7

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.

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 CC.A.14.7.3. Any test results provided to **NGET** should contain sufficient data pre and post fault in order to determine steady state values of all signals, and the power recovery timescales.

In addition to the signals outlined in CC.A.14.1.5 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) Worst case current frequency components (integer, sub or inter harmonic) greater than 5% of the 50Hz component or detailed waveform.
(vii) MW – **Active Power** at the generating unit.
(viii) MVAr – **Reactive Power** at the generating unit.
(ix) Mechanical Rotor Speed
(x) Real / reactive, current / power reference as appropriate
(xi) Fault ride through protection operation (e.g. a crowbar in the case of a doubly fed induction generator)
(xii) Any other signals relevant to the control action of the fault ride through control deemed applicable for model validation.

CC.A.14.7.2 Test Assessment

The test results will be assessed by **NGET** against CC.6.3.15 (a), (b) & (c), CC.A.4.1, CC.A.4.2 & CC.A.4.3. in conjunction with CC.4.4.7

CC.A.14.7.3 Tests:

The tests should be conducted for the following times and for the following fault types.

3 Phase	Phase to Phase	2 Phase to Earth	1 Phase to Earth	Grid Code Ref
0.14s	0.14s	0.14s	0.14s	CC6.3.15a
0.384 0.71s 2.5s 180s				CC6.3.15b Including Figure 5

OPERATING CODE NO. 5

TESTING AND MONITORING

OC5.1 INTRODUCTION

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

(a) monitoring

(i) of **BM Units** against their expected input or output;

(ii) of compliance by **Users** with the **CC** 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 Park Modules**, **DC Converters** and **Generating Units** (excluding **Power Park Units**) to test that they have the capability to comply with the **CC** 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, QPNs, Joint BM Unit Data** and **Dynamic Parameters**.

Provisions regarding the demonstration of compliance, including testing, with the CCs and BC3 is detailed in CC.4 for **Generators** and **DC Converter Station** owners and in CC.3.3 for **LEEMPS/DCCS**. Appendix CC.A.13 provides details concerning compliance testing for synchronous plant and CC.A.14 covers compliance testing for **Power Park Modules**.

CC.4.5 details the process to be followed in certain circumstances to demonstrate ongoing compliance. This process includes testing.

The purpose of testing of generation plant under OC5 is limited to investigations to resolve the position where **NGET** and the **Generator** or **DC Converter Station** owner cannot agree as to whether or not the **Plant** and / or **Apparatus** is fully compliant. Where a **Limited Operational Notification** has been issued in respect of **Plant** and **Apparatus**, the testing provisions of this OC5 (that is, OC5.5) are not applicable to the matters which are the subject of the **Limited Operational Notification**.

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

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

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

(y) 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;

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**.
~~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:

(1) where there is a **BM Unit** registered in the **BSC** in respect of **Generating Units** the provisions of **OC5** shall apply as written;

(2) in all other cases, in respect of each **Generating Unit** 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 **Generating Unit** 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**;

(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, QPN, Joint BM Unit Data** and **Dynamic Parameters**; and

(d) whether **Generators, DC Converter Station** 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 **NGET** and to **Users**, which in **OC5** means:

(a) **Generators**;

(b) **Network Operators;**

(c) **Non-Embedded Customers**;

(d) **Suppliers**; and

(e) **DC Converter Station** owners**.**

OC5.4 MONITORING

OC5.4.1 Parameters to be monitored

NGET 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**; 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 **NGET's** reasonable view, to follow, in any material respect, its expected input or output or a **User** fails persistently to comply with the **CC** and in the case of response to **Frequency**, **BC3** or to provide the **Ancillary Services** it is required, or has agreed, to provide, **NGET** shall notify the relevant **User** giving details of the failure and of the monitoring that **NGET** has carried out.

OC5.4.2.2 The relevant **User** will, as soon as possible, provide **NGET** 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 **Generating Unit** (excluding a **Power Park Unit**), **CCGT Module, Power Park Module** or **DC Converter** to comply with the **CC** 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. Where, in **NGET's** reasonable view, the failure is in relation to compliance with the **CC** and **BC3**, **NGET** shall invoke the process detailed in **CC.4.5.** For **LEEMPS/DCCS** the process defined in CC.3.3.6 will apply.

OC5.4.2.3 Where the process detailed in **CC.4.5** is not invoked **NGET** and the **User** will then discuss the 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 date(s) for the application of the agreed parameters.

OC5.4.2.4 In the event that agreement cannot be reached within 10 days of notification of the failure by **NGET** to the **User**, **NGET** or the **User** shall be entitled to require a test, as set out in OC5.5 and OC5.6, to be carried out.

OC5.5 PROCEDURE FOR INVESTIGATIVE TESTING

OC5.5.1 Request For Investigative Testing

OC5.5.1.1 **NGET** 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 **NGET** has reasonable grounds of justification based upon:

(a) a submission of data, or a statement from a **User** indicating a change in plant or apparatus or settings (including but not limited to governor and excitation control systems) that may reasonably be expected to result in a material change of performance; or

(b) monitoring carried out in accordance with OC5.4.2; or

(c) notification from a **User** of completion of an agreed action from 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**, **QPN, Joint BM Unit Data** 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** 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** or a **DC Converter** meets,

(c) the ~~requirements for operation~~delivery of the **Ancillary Service Agreement** values when in **Frequency Sensitive Mode** and compliance with the requirements for operation in **Limited Frequency Sensitive Mode** in accordance with CC.6.3.3, BC3.5.2 and BC3.7.2; or

(d) the terms of the applicable **Supplemental Agreement** agreed with the **Generator** to have a **Fast Start Capability**; or

(e) the **Reactive Power** capability registered with **NGET** under **OC~~2~~ ~~which shall meet the requirements set out in CC.6.3.2.~~2.** 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 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 **NGET** 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**.

OC5.5.2 Conduct Of Investigative Test

OC5.5.2.1 The performance of the **BM Unit** in respect of the disputed position to be investigated will be recorded at **Transmission Control Centres** notified by **NGET** with monitoring at site when necessary, from voltage and current signals provided by the **User** for each **BM Unit** under CC.6.6.1.

OC5.5.2.2 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**, 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 Park Module** or **DC Converter** at the point of connection in the relevant **User's Control Room**, in the presence of a reasonable number of representatives appointed and authorised by **NGET**. If **NGET** or the **User** requests, monitoring at site will include measurement of ~~the following~~ parameters~~:~~ as set out in CC.A.13 or CC.A.14 as appropriate.

~~(a) for Steam Turbines: governor pilot oil pressure, valve position and steam pressure; or~~

~~(b) for Gas Turbines: Inlet Guide Vane position, Fuel Valve positions, Fuel Demand signal and Exhaust Gas temperature; or~~

~~(c) for Hydro Turbines: Governor Demand signal, Actuator Output signal, Guide Vane position; and/or~~

~~(d) for Excitation Systems: Generator Field Voltage and **Power System Stabiliser** signal where appropriate.~~

~~(e) for **Power Park Modules**: appropriate signals related to the voltage/**Reactive Power**/**Power Factor** control system and the **Frequency** control system as agreed at the time of connection.~~

~~(f) for **DC Converters**: appropriate signals related to the voltage/**Reactive Power**/**Power Factor** control system and the **Frequency** control system as agreed at the time of connection.~~

OC5.5.2.3 The test 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, QPN, Joint BM Unit Data** 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). The instructions in respect of a **CCGT Unit** within a **CCGT Module** will be in respect of the **CCGT Unit**, as provided in BC2.

OC5.5.2.4 The **User** is responsible for carrying out the test when requested by **NGET** in accordance with OC5.5.1 and retains the responsibility for the safety of personnel and plant during the test.

OC5.5.2.5 All testing of generation plant, other than this investigative testing to resolve a disputed compliance position, is carried out under processes defined in the CCs, in particular in CC.A.13 for synchronous plant and CC.A.14 for **Power Park Modules**.

The pass criteria must be read in conjunction with the full text under the Grid Code reference. The **BM Unit**, **CCGT Module**, **Power Park Module** or **Generating Unit** (excluding **Power Park Units**) will pass the test if the criteria below are met:

	Parameter to be Tested	Grid Code Reference	Pass Criteria (to be read in conjunction with the full text under the Grid Code reference)
Voltage Quality	Harmonic Content	CC.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 G5/4.
	Phase Unbalance	CC.6.1.5(b)	The measured maximum **Phase (Voltage) Unbalance** on the **GB Transmission System** should remain, in England and Wales, below 1% and, in Scotland, below 2%.
	Phase Unbalance	CC.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.**
	Voltage Fluctuations	CC.6.1.7(a)	In England and Wales, measured voltage fluctuations at the **Point of Common Coupling** shall not exceed 1% of the voltage level for step changes. Measured voltage excursions other than step changes may be allowed up to a level of 3%. In Scotland, measured voltage fluctuations at a **Point of Common Coupling** shall not exceed the limits set out in **Engineering Recommendation** P28.
	Flicker	CC.6.1.7(b)	Measured voltage fluctuations at a **Point of Common Coupling** shall not exceed, for voltages above 132kV, **Flicker Severity (Short Term)** of 0.8 Unit and **Flicker Severity (Long Term)** of 0.6 Unit, and, for voltages at 132kV and below, shall not exceed **Flicker Severity (Short Term)** of 1.0 Unit and **Flicker Severity (Long Term)** of 0.8 Unit, as set out in **Engineering Recommendation** P28 as current at the **Transfer Date**.

	Parameter to be Tested	Grid Code Reference	Pass Criteria (to be read in conjunction with the full text under the Grid Code reference)
Fault Clearance	Fault Clearance Times	CC.6.2.2.2.2(a) CC.6.2.3.1.1(a)	The fault clearance times shall be in accordance with the **Bilateral Agreement.**
	Back-Up Protection	CC.6.2.2.2.2(b) CC.6.2.3.1.1(b)	The **Back-Up Protection** system provided by **Generators** operates in the times specified in CC.6.2.2.2.2(b). The **Back-Up Protection** system provided by **Network Operators** and **Non-Embedded Customers** operates in the times specified in CC.6.2.3.1.1(b) and with **Discrimination** as specified in the **Bilateral Agreement.**
	Circuit Breaker fail **Protection**	CC.6.2.2.2.2(c) CC.6.2.3.1.1(c)	The circuit breaker fail **Protection** shall initiate tripping so as to interrupt the fault current within 200ms.
Reactive Capability	Reactive Capability	CC.6.3.2 CC.6.3.4	The **Generating Unit** , **DC Converter** or **Power Park Module** will pass the test for reactive delivery if it is within ±5% of the reactive capability registered with **NGET** under **OC2** ~~which shall meet~~**2.** Compliance with the requirements ~~set out in CC.6.3.2.~~ ~~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 **Generating Unit**, **DC Converter** or **Power Park Module** will be maintained by the **Generator** at the voltage specified pursuant to BC2.8 by adjustment of **Reactive Power** on the remaining **Generating Units**, **DC Converters** or **Power Park Modules**, 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** not subject to a **Bilateral Agreement** shall be as confirmed pursuant to OC5.8.3.~~ ~~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 ±5% at 400kV, 275kV and 132kV and lower voltages.~~of the **CC** shall be assessed in accordance with **CC.A.13** and **CC.14**

	Parameter to be Tested	Grid Code Reference	Pass Criteria (to be read in conjunction with the full text under the Grid Code reference)
~~Governor System Compliance~~	**Primary, Secondary** and **High Frequency Response**		The measured response in MW/Hz is within ±5% of the level of response specified in the **Ancillary Services Agreement** for that **Genset.**
	Stability with Voltage	CC.6.3.4	The measured **Active Power** output under steady state conditions of any **Generating Unit** , **DC Converter** or **Power Park Module** directly connected to the **GB Transmission System** should not be affected by voltage changes in the normal operating range.
	~~Governor Standard~~	~~CC.6.3.7(a)~~	~~Measurements indicate that the Governor/**Frequency** control system parameters are within the criteria set out in the appropriate governor/**Frequency** control system standard (the version of which to apply being determined within CC.6.3.7).~~
	~~Governor Stability~~	~~CC.6.3.7(b)~~	~~The measured **Generating Unit** , **DC Converter** or **Power Park Module Active Power Output** shall be stable over the entire operating range of the **Generating Unit**.~~
	~~Governor Droop~~	~~CC.6.3.7(c)(ii)~~	~~The measured speed governor overall speed droop should be between 3% and 5%.~~
	~~Governor Deadband~~	~~CC.6.3.7.(c)(iii)~~	~~Except for the **Steam Unit** within a **CCGT Module,** the measured speed governor/**Frequency** control system deadband shall be no greater than 0.03Hz (for the avoidance of doubt, ±0.015Hz).~~
	~~**Target Frequency**~~	~~CC.6.3.7(d)~~	~~**Target Frequency** settings over at least the range 50 ±0.1 Hz shall be available.~~
	~~Response Capability~~	~~CC.6.3.7(e) CC.A.3~~	~~The measured frequency response of each **Generating Unit** and/or **CCGT Module** which has a **Completion Date** after 1 January 2001 in England and Wales and after 1 April 2005 in Scotland shall meet requirement profile contained in **Connection Conditions** Appendix 3. Similarly for **DC Converters** with **Completion Dates** on or after 1 April 2005 and **Power Park Modules** using the **GB Transmission System** on~~
	~~**Limited High Frequency Response**~~Governor	~~BC3.7.2(b)~~CC. 6.3.7	~~The measured response is within~~Compliance with the requirements of ~~BC3.7.2. i.e.~~ the ~~measured rate of change of **Active Power** output must be at least 2% of output per 0.1Hz deviation of **System Frequency** above 50.4Hz.~~**CC** shall be assessed in
	Output at reduced **System Frequency**	CC.6.3.3 BC3.5.1	For variations in **System Frequency** exceeding 0.1Hz within a period of less than 10 seconds, the **Active Power** output is within ±0.2% of the requirements of CC.6.3.3 when monitored at prevailing external air temperatures of up to 25ºC.

	Parameter to be Tested	Grid Code Reference	Pass Criteria (to be read in conjunction with the full text under the Grid Code reference)
	Fast Start		The **Fast Start Capability** requirements of the **Ancillary Services Agreement** for that **Genset** are met.
	Black Start	OC.5.7.1	The relevant **Generating Unit** or **Power Park Module** is **Synchronised** to the **System** within two hours of the **Auxiliary Gas Turbine(s)** or **Auxiliary Diesel Engine(s)** being required to start.
	Excitation System/ Voltage Control	CC.6.3.8(a) (b) & BC2.11.2	~~Measurements of the continuously acting automatic excitation control system are required to demonstrate the provision of:~~ ~~(i) constant terminal voltage control; or~~ ~~(ii) zero MVAr transfer;or,~~ ~~(iii) voltage control with a **Slope** of the **Generating Unit**, **DC Converter** or **Power Park Module** as applicable without instability over the entire operating range of the **Generating Unit**, **DC Converter** or **Power Park Module**. The measured performance of the automatic excitation or voltage control system should also meet the requirements (including **Power System Stabiliser** performance) specified in the **Bilateral Agreement** or any requirements Specified in an **Embedded Development Agreement**.~~Compliance with the requirements of the **CC** shall be assessed in accordance with **CC.A.13** and **CC.A.14**

	Parameter to be Tested	Grid Code Reference	Pass Criteria
Dynamic Parameters	**Export and Import Limits, QPN, Joint BM Unit Data and Dynamic Parameters**	OC5	The **Export and Import Limits, QPN, Joint BM Unit Data** and **Dynamic Parameters** under test are within 2½% of the declared value being tested. The duration of the test 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.
	Synchronisation time	BC2.5.2.3	**Synchronisation** takes place within ±5 minutes of the time it should have achieved **Synchronisation.** The duration of the test 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.
	Run-up rates	OC5	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.** The duration of the test 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.
	Run-down rates	OC5	Achieves the instructed output within ±5 minutes of the time, calculated from the run-down rates in its **Dynamic Parameters.** The duration of the test 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.

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 **NGET's** reasonable satisfaction, the reliability of the suitable recorders, disclosing calibration records to the extent appropriate.

OC5.5.4 Test Failure/Re-test

OC5.5.4.1 If the **BM Unit, CCGT Modules**, **Power Park Module** or **Generating Unit** (excluding **Power Park Units**) concerned fails to pass the test the **User** must provide **NGET** 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.

OC5.5.4.2 If in **NGETs** reasonable opinion the failure to pass the test relates to compliance with the **CC**s then **NGET** may invoke the process detailed in **CC.4.5**.

OC5.5.4.3 If a dispute arises relating to the failure, **NGET** 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 **NGET** to carry out a re-test on 48 hours' notice which shall be carried out following the procedure set out in OC5.5.2 and OC5.5.3 and subject as provided in OC5.5.1.3, as if **NGET** had issued an instruction at the time of notice from the **User**.

OC5.5.5 Dispute following Re-test

If the **BM Unit**, **CCGT Module**, **Power Park Module** or **Generating Unit** (excluding **Power Park Units**) in **NGET'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, CCGT Module**, **Power Park Module** or **Generating Unit** (excluding **Power Park Units**) has failed the test or re-test (as applicable), the **User** shall within 14 days, or such longer period as **NGET** may reasonably agree, following such failure, submit in writing to **NGET** 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. **NGET** will not unreasonably withhold or delay its approval of the **User's** proposed date and time submitted. Should **NGET** not approve the **User's** proposed date or time (or any revised proposal), the **User** should amend such proposal having regard to any comments **NGET** 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, QPN, Joint BM Unit Data** and/or **Dynamic Parameters**, or in the case of a **BM Unit** comprising a **Generating Unit, CCGT Module**, **DC Converter** or **Power Park Module,** the **User** may amend, with **NGET**'s approval, the relevant registered parameters of that **Generating Unit, CCGT Module**, **DC Converter** 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 **NGET** the date and time that the **BM Unit**, **CCGT Module**, **Power Park Module** or **Generating Unit** (excluding **Power Park Units**) can achieve the parameters previously registered or submitted,

NGET 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 OC5.5.2 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

OC.5.7.1 General

(a) **NGET** may require a **Generator** with a **Black Start Station** to carry out a test (a "**Black Start Test**") on a **Genset** in a **Black Start Station** either while the **Black Start Station** remains connected to an external alternating current electrical supply (a "**BS Unit Test**") or while the **Black Start Station** is disconnected from all external alternating current electrical supplies (a "**BS Station Test**"), in order to demonstrate that a **Black Start Station** has a **Black Start Capability**.

(b) Where **NGET** requires a **Generator** with a **Black Start Station** to carry out a **BS Unit Test**, **NGET** shall not require the **Black Start Test** 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 **Genset** at the **Black Start Station** to be directly affected by the **BS Unit Test**.

(c) **NGET** may require a **Generator** with a **Black Start Station** to carry out a **BS Unit Test** at any time (but will not require a **BS 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, and will not require a **BS Station Test** to be carried out more than once in every two 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).

(d) When **NGET** wishes a **Generator** with a **Black Start Station** to carry out a **Black Start Test**, it shall notify the relevant **Generator** at least 7 days prior to the time of the **Black Start Test** with details of the proposed **Black Start Test**.

OC.5.7.2 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**:

OC.5.7.2.1 **BS 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 **NGET** under **BC2**.

OC.5.7.2.2 **BS 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 OC.5.7.2.1 (e) and (f) shall thereafter be followed.

OC.5.7.2.3 All **Black Start Tests** shall be carried out at the time specified by **NGET** in the notice given under OC5.7.1(d) and shall be undertaken in the presence of a reasonable number of representatives appointed and authorised by **NGET**, who shall be given access to all information relevant to the **Black Start Test**.

OC.5.7.2.4 Failure of a **Black Start Test**

A **Black Start Station** shall fail a **Black Start Test** if the **Black Start Test** shows that it does not have a **Black Start Capability** (~~ie~~i.e. if the relevant **Generating Unit** 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).

OC.5.7.2.5 If a **Black Start Station** fails to pass a **Black Start Test** the **Generator** must provide **NGET** 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 **Generator** after due and careful enquiry. This must be provided within five **Business Days** of the test. If a dispute arises relating to the failure, **NGET** and the relevant **Generator** shall seek to resolve the dispute by discussion, and if they fail to

reach agreement, the **Generator** may require **NGET** to carry out a further **Black Start Test** on 48 hours notice which shall be carried out following the procedure set out in OC.5.7.2.1 or OC.5.7.2.2 as the case may be, as if **NGET** had issued an instruction at the time of notice from the **Generator**.

OC.5.7.2.6 If the **Black Start Station** 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.

OC.5.7.2.7 If following the procedure in OC.5.7.2.5 and OC.5.7.2.6 it is accepted that the **Black Start Station** has failed the **Black Start Test** (or a re-test carried out under OC.5.7.2.5), within 14 days, or such longer period as **NGET** may reasonably agree, following such failure, the relevant **Generator** shall submit to **NGET** in writing for approval, the date and time by which that **Generator** shall have brought that **Black Start Station** to a condition where it has a **Black Start Capability** and would pass the **Black Start Test**, and **NGET** will not unreasonably withhold or delay its approval of the **Generator's** proposed date and time submitted. Should **NGET** not approve the **Generator's** proposed date and time (or any revised proposal) the **Generator** shall revise such proposal having regard to any comments **NGET** may have made and resubmit it for approval.

OC.5.7.2.8 Once the **Generator** has indicated to **NGET** that the **Generating Station** has a **Black Start Capability**, **NGET** shall either accept this information or require the **Generator** to demonstrate that the relevant **Black Start Station** 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 OC.5.7.2 will apply to such test.

OC.5.8 PROCEDURES APPLYING TO **EMBEDDED MEDIUM POWER STATION NOT** SUBJECT TO A **BILATERAL AGREEMENT AND EMBEDDED DC CONVERTER STATIONS** NOT SUBJECT TO A **BILATERAL AGREEMENT**

OC5.8.1 ~~Compliance Statement~~Responsibility and scope

~~Each Network Operator shall ensure that each Embedded Person provides to the Network Operator upon NGET's request:~~

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

~~(b) evidence, where requested, reasonably satisfactory to NGET, of such compliance. Such a request shall not normally be made by NGET more than twice in any calendar year in respect of any Generator's Generating Unit or Power Park Module 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 NGET.~~

The responsibility for compliance of new plant is set out in CC3.3.1 to CC3.3.5. Ongoing compliance for **LEEMPS/DCCS** is covered in CC3.3.6 and this specifies that irrespective of whether **NGET** or the **Network Operator** has

had responsibility for assessing compliance of new **LEEMPS/DCCS** on its initial commissioning, the ongoing responsibility for monitoring and ensuring compliance of the **LEEMPS/DCCS** is with the **Network Operator**. The purpose of OC5.8 is limited to a process to investigate and resolve differences in views about ongoing compliance.

OC5.8.2 **Network Operator's** Obligations to ~~Facilitate Tests~~require Investigative Tests to be undertaken by **LEEMPS/DCCS** in the context of Ongoing Compliance.

If:

(a) the **LEEMPS/DCCS** considers itself fully compliant and the **Network Operator** ~~fails to procure the confirmation referred to at OC5.8.1(a)~~does not agree; or

~~(b) the evidence of compliance is not to NGET's reasonable satisfaction,~~
(b) the **Network Operator** considers the **LEEMPS/DCCS** fully compliant, yet **NGET** is not satisfied about such ongoing compliance,

then, **NGET** shall be entitled to require the **Network Operator** to ~~procure access upon terms reasonably satisfactory to NGET to enable NGET 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~~undertake investigative testing (in accordance with the following provisions of OC5.8) to establish the complete and accurate position in relation to such **Embedded Person**.

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**

NGET 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** 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** 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 Park Module** or **DC Converter** comprising part of the relevant **Embedded Medium Power Station** or **Embedded DC Converter Station** and should only be to demonstrate that:

(a) the relevant **Generating Unit, Power Park Module** or **DC Converter** meets the requirements of the paragraphs in the **CC** which are applicable to such **Generating Units, Power Park Module** or **DC Converter**;

(b) the **Reactive Power** capability registered with **NGET** under **OC2** meets the requirements set out in CC.6.3.2.

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

(a) confirmed to the relevant **Network Operator** the manner in which the test will be conducted, which shall be consistent with the principles established in OC5.5.2; and

(b) received confirmation from the relevant **Network Operator** that the relevant **Generating Unit, Power Park Module** or **DC Converter** 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 **NGET** 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 OC5.5.4, OC5.5.5 and OC5.6 apply to **Embedded Medium Power Stations** not the subject of a **Bilateral Agreement** or **Embedded DC Converter Stations** 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 OC5.5.4, OC5.5.5 and OC5.6 referred to in OC5.8.4(a) are effective so that **NGET** may require, if it so wishes, the provision to it of any reports or other information equivalent to those or that to which **NGET** would be entitled in relation to test failures, re-tests and disputes as to test failures and re-tests under the provisions of OC5.5.4, OC5.5.5 and OC5.6; and

(c) the provisions equivalent to OC5.5.4, OC5.5.5 and OC5.6 referred to in OC5.8.4(a) are effective to permit **NGET** 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** or **Embedded DC Converter Stations** 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 OC5.5.4, OC5.5.5 and OC5.6.

<End of OC5>

.....

CHANGES REQUIRED TO THE DRC.

1. DRC.5.2 shall be amended as follows:

.....

DRC.5 **PROCEDURES AND RESPONSIBILITIES**

DRC.5.1 Responsibility for Submission and Updating of Data

In accordance with the provisions of the various sections of the **Grid Code**, each **User** must submit data as summarised in DRC.6 and listed and collated in the attached schedules.

DRC.5.2 Methods of Submitting Data

DRC.5.2.1 Wherever possible the data schedules to the **DRC** are structured to serve as standard formats for data submission and such format must be used for the written submission of data to **NGET**.

DRC.5.2.2 Data must be submitted to the **Transmission Control Centre** notified by **NGET** or to such other department or address as **NGET** may from time to time advise. The

name of the person at the **User** who is submitting each schedule of data must be included.

DRC.5.2.3 Where a computer data link exists between a **User** and **NGET,** data may be submitted via this link. **NGET** will, in this situation, provide computer files for completion by the **User** containing all the data in the corresponding **DRC** schedule.

Data submitted can be in an electronic format using a proforma to be supplied by **NGET**, or other format to be agreed annually in advance with **NGET**. In all cases the data must be complete and relate to, and only relate ~~only~~ to, what is required by the relevant section of the **Grid Code**.

DRC.5.2.4 Other modes of data transfer~~,~~ such as magnetic tape, may be utilised if **NGET** gives its prior written consent.

DRC.5.2.5 Notwithstanding DRC.5.2.3 and 5.2.4 unless otherwise agreed with **NGET, Generators** and **DC Converter Station** owners submitting data for a **Generating Unit**, **DC Converter**, **Power Park Module** or **CCGT Module** before the issue of a **Final Operational Notification** should submit the **DRC** data schedules and compliance information required under CC.5 electronically using the **User Data File Structure**.

……

2. DRC Schedule 1 shall be amended as follows:

DATA REGISTRATION CODE

SCHEDULE 1
Page 1 of 15

ABBREVIATIONS:

SPD = **Standard Planning Data** **DPD** = **Detailed Planning Data**

% on MVA = % on Rated MVA **RC** = **Registered Capacity**

% on 100 = % on 100 MVA **OC1**, **BC1**, etc = **Grid Code** for which data is required

CUSC Contract = **User** data which may be submitted to the **Relevant Transmission Licensees** by

CUSC App. Form = **User** data which may be submitted to the **Relevant Transmission Licensees** by

	NGET, following the acceptance by a **User** of a **CUSC Contract**.	**NGET**, following an application by a **User** for a **CUSC Contract**.

Note:

All parameters, where applicable, are to be measured at nominal **System Frequency**

+ - these **SPD** items should only be given in the data supplied with the application for a **CUSC Contract**.

* - Asterisk items are not required for **Small Power Stations** and **Medium Power Stations**

Information is to be given on a **Unit** basis, unless otherwise stated. Where references to **CCGT Modules** are made, the columns "G1" etc should be amended to read "M1" etc, as appropriate

□ - These data items may be submitted to the **Relevant Transmission Licensees** from **NGET** in respect of the **GB Transmission System**.
The data may be submitted to the **Relevant Transmission Licensees** in a summarised form e.g. network model; the data transferred will have been originally derived from data submitted by **Users** to **NGET**.

■ - these data items may be submitted to the **Relevant Transmission Licensee** from **NGET** in respect to **Relevant Units** only.
The data may be submitted to the **Relevant Transmission Licensee** in a summarised form e.g. network model; the data transferred will have been originally derived from data submitted by **Users** to **NGET**.

GENERATING UNIT (OR CCGT MODULE) TECHNICAL DATA

POWER STATION NAME: _____ DATE: _____

DATA DESCRIPTION	UNITS	DATA to **RTL** CUSC Contract	CUSC App. Form	DATA CAT.	**GENERATING UNIT** OR STATION DATA FYr 0	FYr 1	FYr 2	FYr 3	FYr 4	FYr 5	FYr 6
GENERATING STATION DEMANDS:											
Demand associated with the **Power Station** supplied through the **GB Transmission System** or the Generator's User System *(PC.A.5.2)*											
- The maximum **Demand** that could occur.	MW Mvar	□ □		**DPD** **DPD**							
- **Demand** at specified time of annual peak half hour of **GB Transmission System Demand** at **Annual ACS Conditions.**	MW Mvar	□ □		**DPD** **DPD**							
- **Demand** at specified time of annual minimum half-hour of **GB Transmission System Demand.**	MW Mvar	□ □		**DPD** **DPD**							
(Additional **Demand** supplied through the unit transformers to be provided below)											
INDIVIDUAL **GENERATING UNIT** (OR AS THE CASE MAY BE, **CCGT MODULE)** DATA					G1	G2	G3	G4	G5	G6	STN
Point of connection to the **GB Transmission System** (or the **Total System** if embedded) of the **Generating Unit** (other than a **CCGT Unit**) or the **CCGT Module**, as the case may be in terms of geographical and electrical location and system voltage *(PC.A.3.4.1)*	Text	□	■	**SPD**							
If the busbars at the **Connection Point** are normally run in separate sections identify the section to which the **Generating Unit** (other than a **CCGT Unit**) or **CCGT Module**, as the case may be is connected *(PC.A.3.1.5)*	Section Number	□	■	**SPD**							
Type of **Unit** (steam, **Gas Turbine Combined Cycle Gas Turbine Unit,** tidal, wind, etc.) *(PC.A.3.2.2 (h))*		□									
A list of the **CCGT Units** within a **CCGT Module**, identifying each **CCGT Unit**, and the **CCGT Module** of which it forms part, unambiguously. In the case of a **Range CCGT Module**, details of the possible configurations should also be submitted. *(PC.A.3.2.2 (g))*		□	■	**SPD**							

DATA DESCRIPTION	UNITS	DATA to **RTL**		DATA CAT.	**GENERATING UNIT** (OR CCGT MODULE, AS THE CASE MAY BE)						
		CUSC Contract	CUSC App. Form		G1	G2	G3	G4	G5	G6	STN
Rated MVA *(PC.A.3.3.1)*	MVA	□	■	**SPD+**							
Rated MW *(PC.A.3.3.1)*	MW	□	■	**SPD+**							
Rated terminal voltage *(PC.A.5.3.2.(a) & PC.A.5.4.2 (b))*	kV	□		**DPD**							
*Performance Chart at **Generating Unit** stator terminals *(PC.A.3.2.2(f)(i))*				**SPD**	(see **OC2** for specification)						
***Output Usable** (on a monthly basis) *(PC.A.3.2.2(b))*	MW			**SPD**	(except in relation to **CCGT Modules** when required on a unit basis under the **Grid Code,** this data item may be supplied under Schedule 3)						
Turbo-Generator inertia constant (for synchronous machines) *(PC.A.5.3.2(a))*	MW secs /MVA	□	■	**SPD+**							
Short circuit ratio (synchronous machines) *(PC.A.5.3.2(a))*		□	■	**SPD+**							
Normal auxiliary load supplied by the **Generating Unit** at rated MW output *(PC.A.5.2.1)*	MW Mvar	□ □		**DPD** **DPD**							
Rated field current at rated MW and Mvar output and at rated terminal voltage *(PC.A.5.3.2 (a))*	A	□		**DPD**							
Field current open circuit saturation curve (as derived from appropriate manufacturers' test certificates): *(PC.A.5.3.2 (a))*	A	□		**DPD**							
120% rated terminal volts	A	□		**DPD**							
110% rated terminal volts	A	□		**DPD**							
100% rated terminal volts	A	□		**DPD**							
90% rated terminal volts	A	□		**DPD**							
80% rated terminal volts	A	□		**DPD**							
70% rated terminal volts	A	□		**DPD**							
60% rated terminal volts	A			**DPD**							
50% rated terminal volts											
IMPEDANCES: (Unsaturated)											
Direct axis synchronous reactance *(PC.A.5.3.2(a))*	% on MVA	□		**DPD**							
Direct axis transient reactance *(PC.A.3.3.1(a)& PC.A.5.3.2(a)*	% on MVA	□	■	**SPD+**							
Direct axis sub-transient reactance *(PC.A.5.3.2(a))*	% on MVA	□		**DPD**							
Quad axis synch reactance *(PC.A.5.3.2(a))*	% on MVA	□		**DPD**							
Quad axis sub-transient reactance *(PC.A.5.3.2(a))*	% on MVA	□		**DPD**							
Stator leakage reactance *(PC.A.5.3.2(a))*	% on MVA	□		**DPD**							
Armature winding direct current resistance. *(PC.A.5.3.2(a))*	% on MVA	□		**DPD**							
In Scotland, negative sequence resistance *(PC.A.2.5.6 (a) (iv)*	% on MVA	□		**DPD**							

Note:- the above data item relating to armature winding direct-current resistance need only be provided by **Generators** in relation to **Generating Units** commissioned after 1st March 1996 and in cases where, for whatever reason, the **Generator** is aware of the value of the data item.

DATA DESCRIPTION	UNITS	DATA to **RTL**		DATA CAT.	**GENERATING UNIT** OR STATION DATA						
		CUSC Contract	CUSC App. Form		G1	G2	G3	G4	G5	G6	STN
TIME CONSTANTS (Short-circuit and Unsaturated)											
Direct axis transient time constant *(PC.A.5.3.2(a))*	S	□		**DPD**							
Direct axis sub-transient time constant *(PC.A.5.3.2(a))*	S	□		**DPD**							
Quadrature axis sub-transient time constant *(PC.A.5.3.2(a))*	S	□		**DPD**							
Stator time constant *(PC.A.5.3.2(a))*	S	□		**DPD**							
GENERATING UNIT STEP-UP TRANSFORMER											
Rated MVA *(PC.A.3.3.1 & PC.A.5.3.2)*	MVA	□	■	**SPD+**							
Voltage Ratio *(PC.A.5.3.2)*	-	□		**DPD**							
Positive sequence reactance: *(PC.A.5.3.2)*											
Max tap	% on MVA	□	■	**SPD+**							
Min tap	% on MVA	□	■	**SPD+**							
Nominal tap	% on MVA	□	■	**SPD+**							
Positive sequence resistance: *(PC.A.5.3.2)*											
Max tap	% on MVA	□		**DPD**							
Min tap	% on MVA	□		**DPD**							
Nominal tap	% on MVA	□		**DPD**							
Zero phase sequence reactance *(PC.A.5.3.2)*	% on MVA	□		**DPD**							
Tap change range *(PC.A.5.3.2)*	+% / -%	□		**DPD**							
Tap change step size *(PC.A.5.3.2)*	%	□		**DPD**							
Tap changer type: on-load or off-circuit *(PC.A.5.3.2)*	On/Off	□		**DPD**							
EXCITATION:											
Note: The data items requested under Option 1 below may continue to be provided by **Generators** in relation to **Generating Units** on the **System** at 9 January 1995 (in this paragraph, the "relevant date") or they may provide the new data items set out under Option 2. **Generators** must supply the data as set out under Option 2 (and not those under Option 1) for **Generating Unit** excitation control systems commissioned after the relevant date, those **Generating Unit** excitation control systems recommissioned for any reason such as refurbishment after the relevant date and **Generating Unit** excitation control systems where, as a result of testing or other process, the **Generator** is aware of the data items listed under Option 2 in relation to that **Generating Unit**.												
Option 1											
DC gain of **Excitation Loop** *(PC.A.5.3.2(c))*		□		*DPD*							
Max field voltage *(PC.A.5.3.2(c))*	V	□		**DPD**							
Min field voltage *(PC.A.5.3.2(c))*	V	□		**DPD**							
Rated field voltage *(PC.A.5.3.2(c))*	V	□		**DPD**							
Max rate of change of field volts: *(PC.A.5.3.2(c))*											
Rising	V/Sec	□		**DPD**							
Falling	V/Sec	□		**DPD**							
Details of **Excitation Loop** *(PC.A.5.3.2(c))* Described in block diagram form showing transfer functions of individual elements	Diagram	□		**DPD**	(please attach)						
Dynamic characteristics of over- excitation limiter		□		**DPD**							

(PC.A.5.3.2(c)) Dynamic characteristics of under-excitation limiter *(PC.A.5.3.2(c))*		□		**DPD**							

DATA DESCRIPTION	UNITS	DATA to **RTL**		DATA CAT.	**GENERATING UNIT** OR STATION DATA						
		CUSC Contract	CUSC App. Form		G1	G2	G3	G4	G5	G6	STN
Option 2											
Exciter category, e.g. **Rotating Exciter**, or **Static Exciter** etc *(PC.A.5.3.2(c))*	Text	□	■	*SPD*							
Excitation System Nominal *(PC.A.5.3.2(c))* **Response** V_E	Sec^{-1}	□		**DPD**							
Rated Field Voltage *(PC.A.5.3.2(c))* U_{fN}	V	□		**DPD**							
No-load Field Voltage *(PC.A.5.3.2(c))* U_{fO}	V	□		**DPD**							
Excitation System On-Load *(PC.A.5.3.2(c))* **Positive Ceiling Voltage** U_{pL+}	V	□		**DPD**							
Excitation System No-Load *(PC.A.5.3.2(c))* **Positive Ceiling Voltage** U_{pO+}	V	□		**DPD**							
Excitation System No-Load *(PC.A.5.3.2(c))* **Negative Ceiling Voltage** U_{pO-}	V	□		**DPD**							
Power System Stabiliser (PSS) *(PC.A.3.4.2* `fitted`	Yes/No	□	■	**SPD**							
Details of **Excitation System** *(PC.A.5.3.2(c))* (including **PSS** if fitted) described in block diagram form showing transfer functions of individual elements.	Diagram	□		*DPD*							
Details of **Over-excitation Limiter** *(PC.A.5.3.2(c))* described in block diagram form showing transfer functions of individual elements.	Diagram	□		*DPD*							
Details of **Under-excitation Limiter** *(PC.A.5.3.2(c))* described in block diagram form showing transfer functions of individual elements.	Diagram	□		*DPD*							

DATA DESCRIPTION	UNITS	DATA to **RTL** CUSC Contract	DATA to **RTL** CUSC App. Form	DATA CAT.	**GENERATING UNIT** OR STATION DATA G1	G2	G3	G4	G5	G6	STN
GOVERNOR AND ASSOCIATED PRIME MOVER PARAMETERS											
Note: The data items requested under Option 1 below may continue to be provided by **Generators** in relation to **Generating Units** on the **System** at 9 January 1995 (in this paragraph, the "relevant date") or they may provide the new data items set out under Option 2. **Generators** must supply the data as set out under Option 2 (and not those under Option 1) for **Generating Unit** governor control systems commissioned after the relevant date, those **Generating Unit** governor control systems recommissioned for any reason such as refurbishment after the relevant date and **Generating Unit** governor control systems where, as a result of testing or other process, the **Generator** is aware of the data items listed under Option 2 in relation to that **Generating Unit**.											
Option 1											
GOVERNOR PARAMETERS (REHEAT UNITS) *(PC.A.5.3.2(d) – Option 1(i))*											
HP Governor average gain	MW/Hz	□		**DPD**							
Speeder motor setting range	Hz	□		**DPD**							
HP governor valve time constant	S	□		**DPD**							
HP governor valve opening limits		□		**DPD**							
HP governor valve rate limits		□		**DPD**							
Re-heat time constant (stored **Active Energy** in reheater)	S	□		**DPD**							
IP governor average gain	MW/Hz	□		**DPD**							
IP governor setting range	Hz	□		**DPD**							
IP governor time constant	S	□		**DPD**							
IP governor valve opening limits		□		**DPD**							
IP governor valve rate limits		□		**DPD**							
Details of acceleration sensitive elements HP & IP in governor loop		□		**DPD**	(please attach)						
Governor block diagram showing transfer functions of individual elements		□		**DPD**	(please attach)						
GOVERNOR (Non-reheat steam and Gas Turbines) *(PC.A.5.3.2(d) – Option 1(ii))*											
Governor average gain	MW/Hz	□		**DPD**							
Speeder motor setting range		□		**DPD**							
Time constant of steam or fuel governor valve	S	□		**DPD**							
Governor valve opening limits		□		**DPD**							
Governor valve rate limits		□		**DPD**							
Time constant of turbine	S	□		**DPD**							
Governor block diagram		□		**DPD**	(please attach)						

DATA DESCRIPTION	UNITS	DATA to **RTL** CUSC Contract	DATA to **RTL** CUSC App. Form	DATA CAT.	**GENERATING UNIT** OR STATION DATA G1	G2	G3	G4	G5	G6	STN
(PC.A.5.3.2(d) – Option 1(iii)) BOILER & STEAM TURBINE DATA*											
Boiler time constant (Stored **Active Energy**)	S			**DPD**							
HP turbine response ratio: (Proportion of **Primary Response** arising from HP turbine)	%			**DPD**							
HP turbine response ratio: (Proportion of **High Frequency Response** arising from HP turbine)	%			**DPD**							
		End of Option 1									
Option 2											
All **Generating Units**											
Governor Block Diagram showing transfer function of individual elements including acceleration sensitive elements		□		**DPD**							
Governor Time Constant *(PC.A.5.3.2(d) – Option 2(i))*	Sec	□		**DPD**							
#Governor Deadband *(PC.A.5.3.2(d) – Option 2(i))*											
- Maximum Setting	±Hz			**DPD**							
- Normal Setting	±Hz			**DPD**							
- Minimum Setting	±Hz			**DPD**							
Speeder Motor Setting Range *(PC.A.5.3.2(d) – Option 2(i))*	%	□		**DPD**							
Average Gain *(PC.A.5.3.2(d) – Option 2(i))*	MW/Hz	□		**DPD**							
Steam Units *(PC.A.5.3.2(d) – Option 2(ii))*											
HP Valve Time Constant	sec	□		**DPD**							
HP Valve Opening Limits	%	□		**DPD**							
HP Valve Opening Rate Limits	%/sec	□		**DPD**							
HP Valve Closing Rate Limits	%/sec	□		**DPD**							
HP Turbine Time Constant *(PC.A.5.3.2(d) – Option 2(ii))*	sec	□		**DPD**							
IP Valve Time Constant	sec	□		**DPD**							
IP Valve Opening Limits	%	□		**DPD**							
IP Valve Opening Rate Limits	%/sec	□		**DPD**							
IP Valve Closing Rate Limits	%/sec	□		**DPD**							
IP Turbine Time Constant *(PC.A.5.3.2(d) – Option 2(ii))*	sec	□		**DPD**							
LP Valve Time Constant	sec	□		**DPD**							
LP Valve Opening Limits	%	□		**DPD**							
LP Valve Opening Rate Limits	%/sec	□		**DPD**							
LP Valve Closing Rate Limits	%/sec	□		**DPD**							
LP Turbine Time Constant *(PC.A.5.3.2(d) – Option 2(ii))*	sec	□		**DPD**							
Reheater Time Constant	sec			**DPD**							
Boiler Time Constant	sec			**DPD**							
HP Power Fraction	%			**DPD**							
IP Power Fraction	%			**DPD**							

Where the generating unit governor does not have a selectable deadband facility, then the actual value of the deadband need only be provided.

DATA DESCRIPTION	UNITS	DATA to **RTL**		DATA CAT.	**GENERATING UNIT** OR STATION DATA						
		CUSC Contract	CUSC App. Form		G1	G2	G3	G4	G5	G6	STN
Gas Turbine Units											
(PC.A.5.3.2(d) – Option 2(iii))											
Inlet Guide Vane Time Constant	sec	□		**DPD**							
Inlet Guide Vane Opening Limits	%	□		**DPD**							
Inlet Guide Vane Opening Rate Limits	%/sec	□		**DPD**							
Inlet Guide Vane Closing Rate Limits	%/sec	□		**DPD**							
(PC.A.5.3.2(d) – Option 2(iii))											
Fuel Valve Time Constant	sec	□		**DPD**							
Fuel Valve Opening Limits	%	□		**DPD**							
Fuel Valve Opening Rate Limits	%/sec	□		**DPD**							
Fuel Valve Closing Rate Limits	%/sec	□		**DPD**							
(PC.A.5.3.2(d) – Option 2(iii))											
Waste Heat Recovery Boiler Time Constant											
Hydro **Generating Units**											
(PC.A.5.3.2(d) – Option 2(iv))											
Guide Vane Actuator Time Constant	sec	□		**DPD**							
Guide Vane Opening Limits	%	□		**DPD**							
Guide Vane Opening Rate Limits	%/sec	□		**DPD**							
Guide Vane Closing Rate Limits	%/sec	□		**DPD**							
Water Time Constant	sec	□		**DPD**							
End of Option 2											
UNIT CONTROL OPTIONS*											
(PC.A.5.3.2(e)											
Maximum droop	%			**DPD**							
Normal droop	%	□		**DPD**							
Minimum droop	%			**DPD**							
Maximum frequency deadband	±Hz			**DPD**							
Normal frequency deadband	±Hz			**DPD**							
Minimum frequency deadband	±Hz			**DPD**							
Maximum Output deadband	±MW			**DPD**							
Normal Output deadband	±MW			**DPD**							
Minimum Output deadband	±MW			**DPD**							
Frequency settings between which Unit Load Controller droop applies:											
Maximum	Hz			**DPD**							
Normal	Hz			**DPD**							
Minimum	Hz			**DPD**							
Sustained response normally selected	Yes/No			**DPD**							

DATA DESCRIPTION	UNITS	DATA to **RTL** CUSC Contract	DATA to **RTL** CUSC App. Form	DATA CAT.	**POWER PARK UNIT** (OR **POWER PARK MODULE**, AS THE CASE MAY BE) G1	G2	G3	G4	G5	G6	STN
Power Park Module Rated MVA *(PC.A.3.3.1(a))*	MVA	□	■	**SPD+**							
Power Park Module Rated MW *(PC.A.3.3.1(a))*	MW	□	■	**SPD+**							
*Performance Chart of a **Power Park Module** at the connection point *(PC.A.3.2.2(f)(ii))*				**SPD**	(see **OC2** for specification)						
***Output Usable** (on a monthly basis) *(PC.A.3.2.2(b))*	MW			**SPD**	(except in relation to **CCGT Modules** when required on a unit basis under the **Grid Code,** this data item may be supplied under Schedule 3)						
Number & Type of **Power Park Units** within each **Power Park Module** *(PC.A.3.2.2(k))*		□									
In the case where an appropriate **Manufacturer's Data & Performance Report** is registered with **NGET** then subject to **NGET's** agreement, the report reference may be given as an alternative to completion of the following sections of this Schedule 1 to the end of page 11 with the exception of the sections marked thus # below.	Reference the **Manufacturer's Data & Performance Report**			**SPD+**							
Power Park Unit Model - A validated mathematical model in accordance with PC.5.4.2 (a)	Transfer function block diagram and algebraic equations, simulation and measured test results	□		**DPD**							
Power Park Unit Data (where applicable)											
Rated MVA *(PC.A.3.3.1(e))*	MVA	□	■	**SPD+**							
Rated MW *(PC.A.3.3.1(e))*	MW	□	■	**SPD+**							
Rated terminal voltage *(PC.A.3.3.1(e))*	V	□	■	**SPD+**							
Site minimum air density *(PC.A.5.4.2(b))*	kg/m^3	□	■	**SPD+**							
Site maximum air density	kg/m^3	□	■	**SPD+**							
Site average air density	kg/m^3	□	■	**SPD+**							
Year for which air density data is submitted		□	■	**SPD+**							
Number of pole pairs		□		**DPD**							
Blade swept area	m^2	□		**DPD**							
Gear Box Ratio		□		**DPD**							
Stator Resistance *(PC.A.5.4.2(b))*	% on MVA	□	■	**SPD+**							
Stator Reactance *(PC.A.3.3.1(e))*	% on MVA	□	■	**SPD+**							
Magnetising Reactance *(PC.A.3.3.1(e))*	% on MVA	□	■	**SPD+**							
Rotor Resistance (at starting). *(PC.A.5.4.2(b))*	% on MVA	□		**DPD**							
Rotor Resistance (at rated running) *(PC.A.3.3.1(e))*	% on MVA	□	■	**SPD+**							
Rotor Reactance (at starting). *(PC.A.5.4.2(b))*	% on MVA	□		**DPD**							
Rotor Reactance (at rated running) *(PC.A.3.3.1(e))*	% on MVA	□	■	**SPD**							
Equivalent inertia constant of the first mass (e.g. wind turbine rotor and blades) at minimum speed *(PC.A.5.4.2(b))*	MW secs /MVA	□	■	**SPD+**							
Equivalent inertia constant of the first mass (e.g. wind turbine rotor and blades) at synchronous speed *(PC.A.5.4.2(b))*	MW secs /MVA	□	■	**SPD+**							
Equivalent inertia constant of the first mass (e.g. wind turbine rotor and blades) at rated speed *(PC.A.5.4.2(b))*	MW secs /MVA	□	■	**SPD+**							
Equivalent inertia constant of the second mass (e.g. generator rotor) at minimum speed *(PC.A.5.4.2(b))*	MW secs /MVA	□	■	**SPD+**							
Equivalent inertia constant of the second mass (e.g. generator rotor) at synchronous speed *(PC.A.5.4.2(b))*	MW secs /MVA	□	■	**SPD+**							
Equivalent inertia constant of the second mass (e.g. generator rotor) at rated speed	MW secs /MVA	□	■	**SPD+**							

DATA DESCRIPTION	UNITS	DATA to **RTL**		DATA CAT.	**POWER PARK UNIT** (OR **POWER PARK MODULE**, AS THE CASE MAY BE)						
		CUSC Contract	CUSC App. Form		G1	G2	G3	G4	G5	G6	STN
(PC.A.5.4.2(b))											
Equivalent shaft stiffness between the two masses *(PC.A.5.4.2(b))*	Nm / electrical radian	□	■	**SPD+**							

DATA DESCRIPTION	UNITS	DATA to **RTL**		DATA CAT.	**POWER PARK UNIT** (OR **POWER PARK MODULE**, AS THE CASE MAY BE)						
		CUSC Contract	CUSC App. Form		G1	G2	G3	G4	G5	G6	STN
Minimum generator rotor speed (Doubly Fed Induction Generators) *(PC.A.3.3.1(e))*	RPM	□	■	**SPD+**							
Maximum generator rotor speed (Doubly Fed Induction Generators) *(PC.A.3.3.1(e))*	RPM	□	■	**SPD+**							
The optimum generator rotor speed versus wind speed *(PC.A.5.4.2(b))*	tabular format	□		**DPD**							
Power Converter Rating (Doubly Fed Induction Generators) *(PC.A.5.4.2(b))*	MVA	□	■	**DPD+**							
The rotor power coefficient (C_p) versus tip speed ratio (λ) curves for a range of blade angles (where applicable) *(PC.A.5.4.2(b))*	Diagram + tabular format	□		**DPD**							
# The electrical power output versus generator rotor speed for a range of wind speeds over the entire operating range of the **Power Park Unit**. *(PC.A.5.4.2(b))*	Diagram + tabular format	□		**DPD**							
The blade angle versus wind speed curve *(PC.A.5.4.2(b))*	Diagram + tabular format	□		**DPD**							
The electrical power output versus wind speed over the entire operating range of **the Power Park Unit**. *(PC.A.5.4.2(b))*	Diagram + tabular format	□		**DPD**							
Transfer function block diagram, parameters and description of the operation of the power electronic converter including fault ride though capability (where applicable). *(PC.A.5.4.2(b))*	Diagram	□		**DPD**							
For a **Power Park Unit** consisting of a synchronous machine in combination with a back to back **DC Converter,** or for a **Power Park Unit** not driven by a wind turbine, the data to be supplied shall be agreed with **NGET** in accordance with PC.A.7. *(PC.A.5.4.2(b))*		□									

DATA DESCRIPTION	UNITS	DATA to **RTL**		DATA CAT.	**POWER PARK UNIT** (OR **POWER PARK MODULE**, AS THE CASE MAY BE)						
		CUSC Contract	CUSC App. Form		G1	G2	G3	G4	G5	G6	STN
Torque / Speed and blade angle control systems and parameters *(PC.A.5.4.2(c))* For the **Power Park Unit**, details of the torque / speed controller and blade angle controller in the case of a wind turbine and power limitation functions (where applicable) described in block diagram form showing transfer functions and parameters of individual elements	Diagram	□		**DPD**							
# Voltage/**Reactive Power**/**Power Factor** control system parameters *(PC.A.5.4.2(d))* # For the **Power Park Unit** and **Power Park Module** details of **Voltage**/**Reactive Power**/**Power Factor** controller (and **PSS** if fitted) described in block diagram form including parameters showing transfer functions of individual elements.	Diagram	□		**DPD**							
# **Frequency** control system parameters *(PC.A.5.4.2(e))* # For the **Power Park Unit** and **Power Park Module** details of the **Frequency** controller described in block diagram form showing transfer functions and parameters of individual elements.	Diagram	□		**DPD**							
As an alternative to PC.A.5.4.2 (a), (b), (c), (d), (e) and (f), is the submission of a single complete model that consists of the full information required under PC.A.5.4.2 (a), (b), (c), (d) (e) and (f) provided that all the information required under PC.A.5.4.2 (a), b), (c), (d), (e) and (f) individually is clearly identifiable. *(PC.A.5.4.2(g))*	Diagram	□		**DPD**							
# Harmonic Assessment Information *(PC.A.5.4.2(h))* (as defined in IEC 61400-21 (2001)) for each **Power Park Unit**:-											
# Flicker coefficient for continuous operation		□		**DPD**							
# Flicker step factor		□		**DPD**							
# Number of switching operations in a 10 minute window		□		**DPD**							
# Number of switching operations in a 2 hour window		□		**DPD**							
# Voltage change factor		□		**DPD**							
# Current Injection at each harmonic for each **Power Park Unit** and for each **Power Park Module**	Tabular format	□		**DPD**							

DC CONVERTER STATION TECHNICAL DATA

DC CONVERTER STATION NAME DATE:_____

Data Description	Units	DATA to **RTL**		Data Category	**DC Converter Station** Data
(PC.A.4)		CUSC Contract	CUSC App. Form		
DC CONVERTER STATION DEMANDS:					
Demand supplied through **Station Transformers** associated with the **DC Converter Station [PC.A.4.1]**					
- **Demand** with all **DC Converters** operating at **Rated MW** import.	MW Mvar	□ □		**DPD** **DPD**	
- **Demand** with all **DC Converters** operating at **Rated MW** export.	MW Mvar	□ □		**DPD** **DPD**	
Additional **Demand** associated with the **DC Converter Station** supplied through the **GB Transmission System. [PC.A.4.1]**					
- The maximum **Demand** that could occur.	MW Mvar	□ □		**DPD** **DPD**	
- **Demand** at specified time of annual peak half hour of **NGET Demand** at **Annual ACS Conditions.**	MW Mvar	□ □		**DPD** **DPD**	
- **Demand** at specified time of annual minimum half-hour of **NGET Demand.**	MW Mvar	□ □		**DPD** **DPD**	
DC CONVERTER STATION DATA					
Number of poles, i.e. number of **DC Converters**	Text	□	■	**SPD+**	
Pole arrangement (e.g. monopole or bipole) Details of each viable operating configuration	Text	□	■	**SPD+**	
Configuration 1 Configuration 2 Configuration 3 Configuration 4 Configuration 5 Configuration 6	Diagram Diagram Diagram Diagram Diagram Diagram	□ □ □ □ □ □	■ ■ ■ ■ ■ ■	**SPD**+	
Remote ac connection arrangement	Diagram	□	■	**SPD**	

Data Description	Units	DATA to **RTL**		Data Category	Operating Configuration					
		CUSC Contract	CUSC App. Form		1	2	3	4	5	6
DC CONVERTER STATION DATA *(PC.A.3.3.1d)*										
DC Converter Type (e.g. current or Voltage source)	Text	□	■	**SPD**						
Point of connection to the **NGET Transmission System** (or the **Total System** if embedded) of the **DC Converter Station** configuration in terms of geographical and electrical location and system voltage	Text	□	■	**SPD**						
If the busbars at the **Connection Point** are normally run in separate sections identify the section to which the **DC Converter Station** configuration is connected	Section Number	□	■	**SPD**						
Rated MW import per pole **[PC.A.3.3.1]**	MW	□	■	**SPD+**						
Rated MW export per pole **[PC.A.3.3.1]**	MW	□	■	**SPD+**						
ACTIVE POWER TRANSFER CAPABILITY (PC.A.3.2.2)										
Registered Capacity	MW	□	■	**SPD**						
Registered Import Capacity	MW	□	■	**SPD**						
Minimum Generation	MW	□	■	**SPD**						
Minimum Import Capacity										
Import MW available in excess of **Registered Import Capacity**.	MW			**SPD**						
Time duration for which MW in excess of **Registered Import Capacity** is available	Min			**SPD**						
Export MW available in excess of **Registered Capacity.**	MW			**SPD**						
Time duration for which MW in excess of **Registered Capacity** is available	Min			**SPD**						
DC CONVERTER TRANSFORMER **[PC.A.5.4.3.1**										
Rated MVA	MVA	□		**DPD**						
Winding arrangement				**DPD**						
Nominal primary voltage	KV	□		**DPD**						
Nominal secondary (converter-side) voltage(s)	KV	□								
Positive sequence reactance				**DPD**						
Maximum tap	% on MVA	□		**DPD**						
Nominal tap	% on MVA	□		**DPD**						
Minimum tap	% on MVA									
Positive sequence resistance				**DPD**						
Maximum tap	% on MVA	□		**DPD**						
Nominal tap	% on MVA	□		**DPD**						
Minimum tap	% on MVA	□		**DPD**						
Zero phase sequence reactance	% on MVA	□		**DPD**						
Tap change range	+% / -%	□		**DPD**						
Number of steps										

Data Description	Units	DATA to **RTL**		Data Category	Operating configuration					
		CUSC Contract	CUSC App. Form		1	2	3	4	5	6
DC NETWORK [PC.A.5.4.3.1 (c)]										
Rated DC voltage per pole	KV	□		**DPD**						
Rated DC current per pole	A	□		**DPD**						
Details of the **DC Network** described in diagram form including resistance, inductance and capacitance of all DC cables and/or DC lines. Details of any line reactors (including line reactor resistance), line capacitors, DC filters, earthing electrodes and other conductors that form part of the **DC Network** should be shown.	Diagram	□		**DPD**						
DC CONVERTER STATION AC HARMONIC FILTER AND REACTIVE COMPENSATION EQUIPMENT **[PC.A.5.4.3.1 (d)]**										
For all switched reactive compensation equipment	Diagram	□	■	**SPD**						
	Text	□	■	**SPD**						
Total number of AC filter banks	Diagram	□	■	**SPD**						
Diagram of filter connections	Text	□	■	**SPD**						
Type of equipment (e.g. fixed or variable)	Mvar	□		**DPD**						
Capacitive rating; or	Mvar	□		**DPD**						
Inductive rating; or	Mvar	□		**DPD**						
Operating range										
Reactive Power capability as a function of various MW transfer levels	Table			**DPD**						

Data Description	Units	DATA to **RTL**		Data Category	Operating configuration					
		CUSC Contract	CUSC App. Form		1	2	3	4	5	6
CONTROL SYSTEMS **[PC.A.5.4.3.2]**										
Static V_{DC} – P_{DC} (DC voltage – DC power) or Static V_{DC} – I_{DC} (DC voltage – DC current) characteristic (as appropriate) when operating as										
–Rectifier	Diagram	□		**DPD**						
–Inverter	Diagram	□		**DPD**						
Details of rectifier mode control system, in block diagram form together with parameters showing transfer functions of individual elements.	Diagram	□		**DPD**						
Details of inverter mode control system, in block diagram form showing transfer functions of individual elements including parameters.	Diagram	□		**DPD**						
Details of converter transformer tap changer control system in block diagram form showing transfer functions of individual elements including parameters. (Only required for DC converters connected to the **GB Transmission System**.)	Diagram	□		**DPD**						
Details of AC filter and reactive compensation equipment control systems in block diagram form showing transfer functions of individual elements including parameters. (Only required for DC converters connected to the **GB Transmission System**.)	Diagram	□		**DPD**						
Details of any frequency and/or load control systems in block diagram form showing transfer functions of individual elements including parameters.	Diagram	□		**DPD**						
Details of any large or small signal modulating controls, such as power oscillation damping controls or sub-synchronous oscillation damping controls, that have not been submitted as part of the above control system data.	Diagram	□		**DPD**						
Transfer block diagram representation of the reactive power control at converter ends for a voltage source converter.		□		**DPD**						
LOADING PARAMETERS **[PC.A.5.4.3.3]**										
MW Export										
Nominal loading rate	MW/s			**DPD**						
Maximum (emergency) loading rate	MW/s			**DPD**						
MW Import										
Nominal loading rate	MW/s			**DPD**						
Maximum (emergency) loading rate	MW/s			**DPD**						
Maximum recovery time, to 90% of pre-fault loading, following an AC system fault or severe voltage depression.	s	□		**DPD**						
Maximum recovery time, to 90% of pre-fault loading, following a transient DC Network fault.	s	□		**DPD**						

NOTE:

Users are referred to Schedules 5 & 14 which set down data required for all **Users** directly connected to the **GB Transmission System**, including **Power Stations**.

3. Schedule 14 shall be replaced with the following:

DATA REGISTRATION CODE

FAULT INFEED DATA

The data in this Schedule 14 is all **Standard Planning Data,** and is to be provided by **Generators**, with respect to all directly connected **Power Stations**, all **Embedded Large Power Stations** and all **Embedded Medium Power Stations** connected to the **Subtransmission System**. A data submission is to be made each year in Week 24.

Fault infeeds via **Unit Transformers**

A submission should be made for each **Generating Unit** with an associated **Unit Transformer**. Where there is more than one **Unit Transformer** associated with a **Generating Unit**, a value for the total infeed through all **Unit Transformers** should be provided. The infeed through the **Unit Transformer(s)** should include contributions from all motors normally connected to the **Unit Board**, together with any generation (~~eg~~e.g. **Auxiliary Gas Turbines**) which would normally be connected to the **Unit Board**, and should be expressed as a fault current at the **Generating Unit** terminals for a fault at that location.

DATA DESCRIPTION	UNITS	F.Yr. 0	F.Yr. 1	F.Yr 2	F.Yr. 3	F.Yr. 4	F.Yr. 5	F.Yr. 6	F.Yr.7	DATA to **RTL**	
(PC.A.2.5)										CUSC Contract	CUSC App. Form
Name of **Power Station**										□	■
Number of **Unit Transformer**										□	■
Symmetrical three phase short-circuit current infeed through the **Unit Transformers**(s) for a fault at the **Generating Unit** terminals											
- at instant of fault	kA									□	■
- after subtransient fault current contribution has substantially decayed	kA									□	■
Positive sequence X/R ratio at instance of fault										□	■
Subtransient time constant (if significantly different from 40ms)	ms									□	■
Pre-fault voltage at fault point (if different from 1.0 p.u.)										□	■
The following data items need only be supplied if the **Generating Unit** Step-up Transformer can supply zero sequence current from the **Generating Unit** side to the **GB Transmission System**											
Zero sequence source impedances as seen from the **Generating Unit** terminals consistent with the maximum infeed above:											
- Resistance	% on 100									□	■

- Reactance	% on 100									□	■

Fault infeeds via **Station Transformers**

A submission is required for each **Station Transformer** directly connected to the **GB Transmission System**. The submission should represent normal operating conditions when the maximum number of **Gensets** are **Synchronised** to the **System**, and should include the fault current from all motors normally connected to the **Station Board**, together with any Generation (~~eg~~e.g. **Auxiliary Gas Turbines**) which would normally be connected to the **Station Board**. The fault infeed should be expressed as a fault current at the hv terminals of the **Station Transformer** for a fault at that location.

If the submission for normal operating conditions does not represent the worst case, then a separate submission representing the maximum fault infeed that could occur in practice should be made.

DATA DESCRIPTION	UNITS	F.Yr. 0	F.Yr. 1	F.Yr. 2	F.Yr. 3	F.Yr. 4	F.Yr. 5	F.Yr. 6	F.Yr. 7	DATA to **RTL**	
(PC.A.2.5)										CUSC Contract	CUSC App. Form
Name of **Power Station**										□	■
Number of **Station Transformer**										□	■
Symmetrical three phase short-circuit current infeed for a fault at the **Connection Point**											
- at instant of fault	kA									□	■
- after subtransient fault current contribution has substantially decayed	kA									□	■
Positive sequence X/R ratio At instance of fault										□	■
Subtransient time constant (if significantly different from 40ms)	mS									□	■
Pre-fault voltage (if different from 1.0 p.u.) at fault point (See note 1)										□	■
Zero sequence source Impedances as seen from the **Point of Connection** Consistent with the maximum Infeed above:											
- Resistance	% on 100									□	■
- Reactance	% on 100									□	■

Note 1. The pre-fault voltage provided above should represent the voltage within the range 0.95 to 1.05 that gives the highest fault current

Note 2. % on 100 is an abbreviation for % on 100 MVA

Fault infeeds from **Power Park Modules**

A submission is required for the whole **Power Park Module** and for each **Power Park Unit** type or equivalent. The submission shall represent operating conditions that result in the maximum fault infeed. The fault current from all motors normally connected to the **Power Park Unit's electrical system** shall be included. The fault infeed shall be expressed as a fault current at the terminals of the **Power Park Unit,** or the **Common Collection Busbar** if an equivalent **Single Line Diagram** and associated data as described in PC.A.2.2.2 is provided, and the **Grid Entry Point**, or **User System Entry Point** if **Embedded**, for a fault at the **Grid Entry Point**, or **User System Entry Point** if **Embedded**.

Should actual data in respect of fault infeeds be unavailable at the time of the application for a **CUSC Contract** or **Embedded Development Agreement**, a limited subset of the data, representing the maximum fault infeed that may result from all of the plant types being considered, shall be submitted. This data will, as a minimum, represent the root mean square of the positive, negative and zero sequence components of the fault current for both single phase and three phase solid faults at the **Grid Entry Point** (or **User System Entry Point** if **Embedded**) at the time of fault application and 50ms following fault application. Actual data in respect of fault infeeds shall be submitted to **NGET** as soon as it is available, in line with PC.A.1.2

DATA DESCRIPTION	UNITS	F.Yr. 0	F.Yr. 1	F.Yr. 2	F.Yr. 3	F.Yr. 4	F.Yr. 5	F.Yr. 6	F.Yr. 7	DATA to **RTL**	
(PC.A.2.5)										CUSC Contract	CUSC App. Form
Name of **Power Station**										□	■
Name of Power Park Module										□	■
Power Park Unit **type**										□	■
In the case where an appropriate **Manufacturer's Data & Performance Report** is registered with **NGET**, then, subject to **NGET's** agreement completion of the following sections of this Schedule 14 is not required. State report reference.											
A submission shall be provided for the contribution of the entire **Power Park Module** and each type of **Power Park Unit** or equivalent to the positive, negative and zero sequence components of the short circuit current at the **Power Park Unit** terminals, or **Common Collection Busbar**, and **Grid Entry Point** or **User System Entry Point** if **Embedded** for (i) a solid symmetrical three phase short circuit (ii) a solid single phase to earth short circuit (iii) a solid phase to phase short circuit (iv) a solid two phase to earth short circuit at the **Grid Entry Point** or **User System Entry Point** if **Embedded.**										□ □ □ □ □	■ ■ ■ ■ ■
If protective controls are used and active for the above conditions, a submission shall be provided in the											

limiting case where the protective control is not active. This case may require application of a non-solid fault, resulting in a retained voltage at the fault point.											
- A continuous time trace and table showing the root mean square of the positive, negative and zero sequence components of the fault current from the time of fault inception to 140ms after fault inception at 10ms intervals	Graphical and tabular kA versus s									□	■
- A continuous time trace and table showing the positive, negative and zero sequence components of retained voltage at the terminals or **Common Collection Busbar**, if appropriate	p.u. versus s									□	■
- A continuous time trace and table showing the root mean square of the positive, negative and zero sequence components of retained voltage at the fault point, if appropriate	p.u. versus s									□	■
For **Power Park Units** that utilise a protective control, such as a crowbar circuit,											
- additional rotor resistance applied to the **Power Park Unit** under a fault situation	% on MVA % on MVA									□ □	■ ■
- additional rotor reactance applied to the **Power Park Unit** under a fault situation.											
Positive sequence X/R ratio of the equivalent at time of fault at the **Common Collection Busbar**										□	■
Minimum zero sequence impedance of the equivalent at **Common Collection Busbar**										□	■
Active Power generated pre-fault	MW									□	■
Number of **Power Park Units** in equivalent generator										□	■
Power Factor (lead or lag)										□	■
Pre-fault voltage (if different from 1.0 p.u.) at fault point (See note 1)	p.u.									□	■
Items of reactive compensation										□	■

switched in pre-fault											

Note 1. The pre-fault voltage provided above should represent the voltage within the range 0.95 to 1.05 that gives the highest fault current

4. A new DRC Schedule 18 will be inserted as follows:

DRC.18 User Data File Structure

The specimen structure of the **User Data File Structure** is given below.

User Data File Structure – Specimen Structure

Part A: Commercial & Legal

- 2.2.1 Signed Legal Agreements
- 2.2.2 Commissioning & Test Programmes
  - Connection Site Commissioning & Test Programme
  - Generating Unit Commissioning Program
  - Generator Control Test Procedures and Programme
- 2.2.3 Statements of Readiness
- 2.2.4 TOGA Registration Details
- 2.2.5 Mandatory Services Agreement
- 2.2.6 Codes for Balancing Market Units
- 2.2.7 BMU Registration
- 2.2.8 Balancing Mechanism Process
- 2.2.9 Ancillary Services Monitoring
- 2.2.10 User Self Certification of Compliance
- 2.2.11 Compliance Statement

Part 1: Safety & System Operation

- 2.1 Interface Agreements
- 2.2 Safety Rules
- 2.3 Local Switching Procedures
- 2.4 Earthing
- 2.5 Site Responsibility Schedules
- 2.6 Operational and Gas Zone Diagrams
- 2.7 Site Common Drawings
- 2.8 Control Telephony
- 2.9 Local Safety Procedures
- 2.10 Safety Co-ordinators
- 2.11 RISSP
- 2.12 Telephone Numbers for Joint System Incidents
- 2.13 Contact Details (fax, tel, email)
- 2.14 Local Joint Restoration Plan (incl. black start if applicable)
- 2.15 Maintenance Standards

Part 2: Connection Technical Data

- 3.1 DRC Schedule 5 – Users System Data
  - *3.1.1 System Configuration Data*
    - Users System Layout & Single Line Diagram
    - Reactive Compensation
    - Substation Infrastructure
    - Circuit Parameters
    - Transformer Data
    - Switchgear Data

User Data File Structure – Specimen Structure

- *3.1.2 Protection Systems*
  - User System protection and settings
  - User System Auto Reclose facilities & settings
  - Circuit Breaker Fail
  - Generator Transformer protection and settings
  - System Fault Clearance Times
  - Generator protection and settings
- *3.1.3 User System Studies (if required)*
- 3.2 Protection Settings Reports
- *3.6.1 Protection Discrimination Review*
- *3.6.2 Protection of Interconnecting Connections*
- 3.3 Special Automatic Facilities e.g. intertrip
- 3.4 Operational Metering
- 3.5 Tariff Metering
- 3.6 Operational Communications
  - a. *EDL & EDT*
- 3.7 Performance Monitoring
- *3.8.1 Ancillary Services Monitoring*
- *3.8.2 Fault Recorder*
- *3.8.3 Dynamic System Monitor (if required)*
- *3.8.4 Power Quality Monitor (if required)*
- 3.8 Power Quality Test Results (if required)

Part 3: Generator Technical Data

- 4.1 DRC Schedule 1 - Generating Unit Technical Data
  - a. *Table of Generator Parameters*
  - b. *Controls System Details*
  - c. *Generator / Station Model*
  - d. *Power Quality - Harmonic Assessment Information*
- 4.2 DRC Schedule 2 - Generation Planning Data
- 4.3 DRC Schedule 4 – Frequency Droop & Response
- 4.4 DRC Schedule 14 – Fault Infeed Data – Generators
- 4.5 Special Generator Protection
  - Pole Slipping Protection
  - Islanding Protection Schemes
- 4.6 Compliance Tests & Evidence
  - *2.7.1 Reactive Capability*
  - *2.7.2 Voltage Control (e.g. Excitation, AVR PSS)*
  - *2.7.3 Frequency Response (Governor)*
  - *2.7.4 Fault Ride Through*
- 4.7 Compliance Simulation Studies
  - *(i) Model Verification*
  - *(ii) Reactive Capability & Voltage Range*
  - *(iii) Voltage Control & Stability (e.g. AVR, PSS)*
  - *(iv) Fault Ride Through*
- 4.8 Site Specific Technical Data & Compliance
  - *(a) Special Automatic Features e.g. intertrip*

Part 4: General DRC Schedules

- 3.7.1 DRC Schedule 3 – Large Power Station Outage Information
- 3.7.2 DRC Schedule 6 – Users Outage Information
- 3.7.3 DRC Schedule 7 – Load Characteristics
- 3.7.4 DRC Schedule 8 – BM Unit Data (if applicable)
- 3.7.5 DRC Schedule 10 – Demand Profiles
- 3.7.6 DRC Schedule 11 – Connection Point Data

Document comparison done by Workshare Professional on 27 January 2009 14:11:46

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Rendering set	standard

Legend:	
Insertion	
~~Deletion~~	
~~Moved from~~	
Moved to	
Style change	
Format change	
~~Moved deletion~~	
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Deleted cell	
Moved cell	
Split/Merged cell	
Padding cell	

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Moved from	13
Moved to	13
Style change	0
Format changed	0
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APPENDIX 3 PROPOSED ADDITIONAL GRID CODE COMPLIANCE CHANGES FOR OFFSHORE

It is proposed to add the following clause to the CC.5

CC.5.5.5 In the case of **Offshore Power Park Modules** the tests outlined in CC.5.5.1.1 (a) and CC.5.5.1.1 (b) are not required however the offshore reactive power transfer tests outlined in CC.A.14.8 shall be completed in their place.

Proposed paragraph to capture the 15% retained voltage option 2 for Offshore PPM connections.

It is proposed to add the following clause to CC Appendix 8:

Offshore Generation

CC.A.8.5.3 In the case of an **Offshore Power Park Module** or **Offshore DC Converter** the studies may instead be completed at the **LV Side of the Offshore Platform.** For fault simulation studies described in CCA.8.5.1(i) and CCA.8.5.1(ii) a retained voltage of 15% or lower may be applied at the **LV Side of the Offshore Platform** on the faulted phases. For voltage dip simulation studies described in CC.A.8.5.1(iii) the same voltage levels and durations as normally applied at the **GB Transmission System** operating at **Supergrid Voltage** will be applied at the **LV Side of the Offshore Platform.**

It is proposed to add the following test in CC Appendix 14, numbered CC.A14.8

CC.A.14.8 Offshore Reactive Power transfer Tests

CC.A.14.8.1 Description of Tests:

This section details the procedure for conducting reactive power transfer control tests on **Offshore Power Park Modules**. These tests should be carried out when at least 95% of the **Power Park Units** within the **Offshore Power Park Module** in service. There should be sufficient power resource available to generate at least 85% of the **Registered Capacity** of the **Offshore Power Park Module**.

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**.

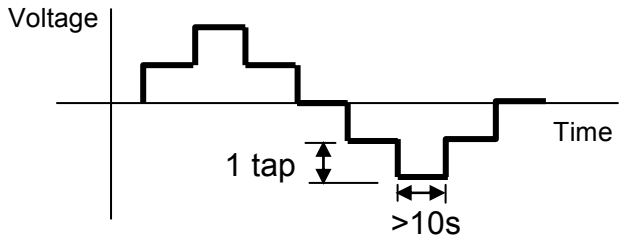
System voltage changes should be created by a series of multiple upstream transformer taps. Where possible the transformer located on the offshore platform [is this a defined term?] should be used for this purpose. The **User** should coordinate with the relevant network operator in order to conduct the required tests. The time between transformer taps should be at least 10 seconds as per CC.A.14.8 Figure 1.

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. Note that this test does not need to be conducted provided that the frequency response tests as outlined in CC.A.14.6 are completed however the results from these tests will be assessed against the criteria outlined in CC.A.14.8.2.

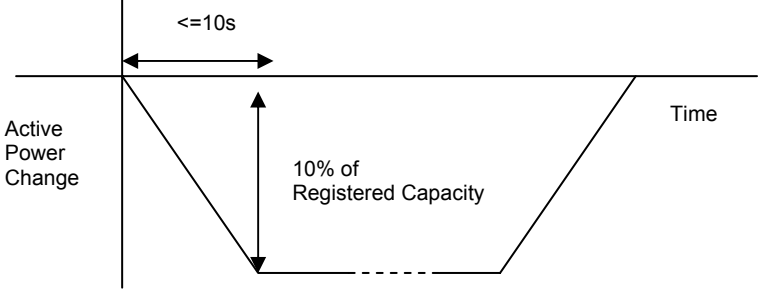
CC.A.14.8.2 Test Assessment:

The test results will be assessed against:
CC.6.3.2(e)(i), CC.6.3.2(e)(ii) and the **Bilateral Agreement**

CC.A.14.8.3 Tests:



CC.A.14.8 Figure 1 – Transformer tap sequence for reactive transfer tests



CC.A.14.8 Figure 2 – Active Power ramp for reactive transfer tests

Appendix 4 - INDICATIVE STAGES FOR PROGRESSING DRAFTING AMENDMENTS TO THE GRID CODE, CUSC, DCODE AND DCUSA

NOTE: IT IS EXPECTED THAT ALL FOUR REPORTS WILL BE ISSUED TO THE AUTHORITY AT CLOSELY THE SAME TIME.