

Stage 02: Industry Consultation

Grid Code

GC0023 – Protection Fault Clearance Time & Back-Up Protection

What stage is this document at?

01	Workgroup Report
02	Industry Consultation
03	Report to the Authority

This proposal seeks to modify the Grid Code to clarify the role, details and Fault Clearance times required from User Back-Up Protection systems to ensure optimal discrimination.

This document is open for Industry Consultation. Any interested party is able to make a response in line with the guidance set out in Section 5 of this document.

Published on: 25 August 2015
Length of Consultation: 20 Working Days
Responses by: 22 September 2015



National Grid recommends:

GC0023 should be implemented as it better facilitates Applicable Grid Code objectives (i) and (iii)



High Impact:

Directly connected Generators or directly connected Distribution Network Operators / Non-Embedded Customers and directly connected DC Converter Stations



Medium Impact:

None identified



Low Impact:

None identified

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Any Questions?

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About this document

This Industry Consultation outlines the information required for interested parties to form an understanding of a defect within the Grid Code and seeks the views of interested parties in relation to the issues raised by this document.

Parties are requested to respond by **22 September 2015** to grid.code@nationalgrid.com

Proposer:

National Grid

Document Control

Version	Date	Author	Change Reference
0.1	31 July 2015	National Grid	Draft Industry Consultation for GCRP
1.0	25 August 2015	National Grid	Final Industry Consultation

1 Executive Summary

- 1.1 This document describes the GC0023 Modification Proposal and seeks views from industry members relating to the proposal.
- 1.2 GC0023 proposes to correct current terminology (faster / slower) in CC.6.2.2.2.2 and CC.6.2.3.1.1 of the Grid Code which relates to Generator, Distribution Network Operator (DNO), Non-Embedded Customer & DC Converter Station fault clearance time as well as the SI units (**ms** - milliseconds) used to define fault clearance time.
- 1.3 In addition GC0023 also proposes to introduce additional wording in CC.6.2.2.2.2 (b) to add further clarity to the minimum fault clearance time required on Generator Back-Up Protection systems.
- 1.4 GC0023 introduces changes to the existing definitions of Back-Up Protection and Main Protection and the addition of new definitions for Independent Main Protection and Independent Back-Up Protection.
- 1.5 An issue pro forma for GC0023 was originally completed by National Grid and submitted to the Grid Code Review Panel for their consideration in November 2008. The Panel determined that the proposal should be progressed to a Workshop to further clarify the requirements.
- 1.6 Following the Workshop held on 20 March 2009, National Grid conducted a survey to assess the sites that posed a potential risk to the Transmission System and have taken the necessary actions to eliminate the risk. National Grid has adopted a best practice approach for Protection requirements through the compliance process since 2009.
- 1.7 GC0023 proposes to embed the best practice approach for Protection settings currently used during the compliance process into the Grid Code.

Timeline of Events

Sep 2007 - Issue first raised at GCRP
Nov 2007 - Issue paper presented at GCRP
Nov 2008 - Presented at GCRP
Mar 2009 - One-off Workshop
Post Mar 2009 - NG conducted survey on existing generators
Jul 2012 - Issue paper re-raised at GCRP
Oct 2013 - Legal text presented to GCRP
Mar 2015 - Issue re-raised at GCRP
Mar - Jun 2015 - Legal text drafted
Jul 2015 - Consultation drafted
Jul 2015 - Consultation / legal text circulated to GCRP
Aug 2015 - Industry Consultation published

2 Why Change?

- 2.1 GC0023 identified two Grid Code deficiencies. The first relates to the current terminology (faster / slower) in CC.6.2.2.2.2 and CC.6.2.3.1.1 of the Grid Code which relates to Generator. Distribution Network Operator (DNO), Non-Embedded Customer & DC Converter Station's fault clearance time as well as the SI units (**ms** - milliseconds). The second relates to Grid Code CC.6.2.2.2.2 (b) which is designed to ensure that Generators directly connected to the transmission network provide Back-Up Protection for the detection of uncleared HV connection faults. This requirement is to ensure that Generator's Backup Protection is coordinated with NGET's Back-Up Protection.
- 2.2 The first issue is related to CC.6.2.2.2.2 and CC.6.2.3.1.1. The current terminology (faster / slower) used in the Grid Code referring to the fault clearance time is incorrect. The correct terminology is shorter / longer which is the standard industry wide term used in relation to fault clearance time on Protection equipment.
- 2.3 In addition the SI unit **mS** currently used for fault clearance time in CC.6.2.2.2.2 (a) and CC.6.2.3.1.1 (a) is incorrect as it stands for milli-Siemens, a unit of electrical susceptance, and hence should be changed to **ms (milli-seconds)**.
- 2.4 The second issue relates to CC.6.2.2.2.2 (b). National Grid's role in managing the Grid Code compliance process for new generators connecting to the system and ongoing compliance for existing generators highlighted potentially inadequate discrimination between National Grid's and the Generator's Backup Protection systems. It was also unclear why the Back-up Protection requirements were different in England and Wales (800ms) from those in Scotland (300ms).
- 2.5 The consequences of inadequate discrimination is that in the event of a failure on the Main Protection System an uncleared HV connections fault could result in fault clearance by National Grid's feeder remote end Back-up Protection (typically at 500ms). This would typically result in the loss of both the local substation and the connected transmission feeder circuits from the respective remote ends.
- 2.6 CC.6.2.2.2.2 (b) currently does not adequately clarify:
 - That the Back-Up Protection has to be separate from the Main Protection;
 - That the function should be supported by a separate Current Transformer (CT) (i.e. does not share the same CT as the Main Protection); or
 - Under what circumstances the function may be provided as part of the Main Protection (e.g. when two Main Protection systems are provided)

3 Solution

- 3.1 So far as the deficiency associated with CC.6.2.2.2 and CC.6.2.3.1.1 is concerned this is a simple text change to reflect current practice.
- 3.2 So far as CC.6.2.2.2 (b) is concerned the solution was slightly more complex. In 2009, National Grid conducted a survey on connections before 01 January 2009 to assess whether any sites were at risk and whether any remedial work was required. Where remedial work was identified as being necessary, this has been completed and National Grid is satisfied that the connections before 01 January 2009 are compliant. Since January 2009, National Grid has, as part of the compliance process ensured that these issues were covered for any new connections. On this basis this proposal only looks to implement the changes for connections after the “**Date of Approval**” of this modification and no retrospective work will be required.
- 3.3 GC0023 seeks to implement the proposed legal text changes identified in Annex 1.
- 3.4 It is proposed to amend CC.6.2.2.2, CC.6.2.3.1 and the Glossary and Definitions of the Grid Code to address the above issues.

4 Impact & Assessment

Impact on the Grid Code

- 4.1 GC0023 requires amendments to the following parts of the Grid Code:
- Connection Conditions CC.6.2.2.2 / CC.6.2.3.1 and some minor amendments to the Glossary and Definitions
- 4.2 The text required to give effect to the proposal is contained in Annex 1 of this document.

Impact on National Electricity Transmission System (NETS)

- 4.3 The proposed changes will not have an adverse impact on the Transmission System.

Impact on Grid Code Users

- 4.4 The proposed changes will clarify the requirements placed on Users connecting to the system in respect of the protection requirements.

Impact on Greenhouse Gas emissions

- 4.5 The proposed changes will not have a material impact on Greenhouse Gas Emissions.

Assessment against Grid Code Objectives

- 4.6 National Grid considers that GC0023 will better facilitate the Grid Code objective:

- (i) to permit the development, maintenance and operation of an efficient, coordinated and economical system for the transmission of electricity;

The proposed changes permit the operation of an efficient transmission system by removing any confusion within the Grid Code requirements in facilitating the operation of protection systems so as to cause the minimum loss to the Transmission System.

- (ii) to facilitate competition in the generation and supply of electricity (and without limiting the foregoing, to facilitate the National Electricity Transmission System being made available to persons authorised to supply or generate electricity on terms which neither prevent nor restrict competition in the supply or generation of electricity);

The proposed changes have a neutral impact on this objective

- (iii) subject to sub-paragraphs (i) and (ii), to promote the security and efficiency of the electricity generation, transmission and distribution systems in the National Electricity Transmission System operator area taken as a whole; and

With the clauses in the Grid Code clarified, it will remove any possible confusion regarding the operation of protection systems and promote a more secure transmission system.

- (iv) to efficiently discharge the obligations imposed upon the licensee by this license and to comply with the Electricity Regulation and any relevant legally binding decisions of the European Commission and/or the Agency.

The proposed changes have a neutral impact on this objective

Impact on core industry documents

4.7 The proposed modification only requires changes to the Grid Code.

Impact on other industry documents

4.8 The proposed modification does not impact on any other industry documents

Implementation

4.9 National Grid proposes GC0023 should be implemented 10 business days after an Authority decision. Views are invited on this proposed implementation date.

5 Consultation Responses

5.1 Views are invited upon the proposals outlined in this consultation, which should be received by **22 September 2015**.

Your formal responses may be emailed to: grid.code@nationalgrid.com

5.2 Views are invited to the following questions:

- Do you believe that GC0023 better facilitates the applicable Grid Code Objective as set out in paragraph 4.6?
- Do you support the proposed implementation approach in paragraph 4.9?
- Do you support the proposed changes to CC.6.2.2.2 and CC.6.2.3.1?

5.3 Views are invited upon the proposals outlined in this consultation.

5.4 If you wish to submit a confidential response please note the following:

- (i) Information provided in response to this consultation will be published on National Grid's website unless the response is clearly marked "Private & Confidential", we will contact you to establish the extent of the confidentiality. A response marked "Private and Confidential" will be disclosed to the Authority in full but, unless agreed otherwise, will not be shared with the Grid Code Review Panel or the industry and may therefore not influence the debate to the same extent as a non confidential response.
- (ii) Please note an automatic confidentiality disclaimer generated by your IT System will not in itself, mean that your response is treated as if it had been marked "Private and Confidential".

Annex 1 - Proposed Legal Text

CC.6.2.2 Requirements at Connection Points or, in the case of OTSDUW at Interface Points that relate to Generators or OTSDUW Plant and Apparatus or DC Converter Station owners

CC.6.2.2.1 Not Used.

CC.6.2.2.2 Generating Unit, OTSDUW Plant and Apparatus and Power Station Protection Arrangements

CC.6.2.2.2.1 Minimum Requirements

Protection of Generating Units (other than Power Park Units), DC Converters, **OTSDUW Plant and Apparatus** or Power Park Modules and their connections to the **National Electricity Transmission System** ~~must~~shall meet the ~~minimum~~ requirements given below. These are necessary to reduce ~~to a practical minimum~~ the impact on the **National Electricity Transmission System** of faults on **OTSDUW Plant and Apparatus** circuits or circuits owned by Generators or DC Converter Station owners.

CC.6.2.2.2.2 Fault Clearance Times

(a) The required fault clearance ~~time~~time for faults on the Generator's or DC Converter Station owner's equipment directly connected to the **National Electricity Transmission System** or **OTSDUW Plant and Apparatus** and for faults on the **National Electricity Transmission System** directly connected to the Generator or DC Converter Station owner's equipment or **OTSDUW Plant and Apparatus**, from fault inception to the circuit breaker arc extinction, shall be set out in ~~accordance with~~ the **Bilateral Agreement**. The ~~time~~fault clearance time specified in ~~accordance with~~ the **Bilateral Agreement** shall not be ~~faster~~shorter than the durations specified below:

- (i) ~~80ms~~80ms at 400kV
- (ii) ~~400ms~~100ms at 275kV
- (iii) ~~420ms~~120ms at 132kV and below

but this shall not prevent a the **User** or **NGET** or a **Generator** (including in respect of **OTSDUW Plant and Apparatus** having faster) from selecting shorter fault clearance ~~time~~time on their own Plant and Apparatus provided Discrimination is achieved.

SlowerA longer fault clearance ~~time~~time may be specified in ~~accordance with~~ the **Bilateral Agreement** for faults on the **National Electricity Transmission System**. SlowerA longer fault clearance ~~time~~time for faults on the **Generator** or **DC Converter Station** owner's equipment or **OTSDUW Plant and Apparatus** may be agreed with NGET in accordance with the terms of the **Bilateral Agreement** but only if **System** requirements, in **NGET's** view, permit. The probability that the fault clearance ~~time~~time stated in ~~accordance with~~ the **Bilateral Agreement** will be exceeded by any given fault, must be less than 2%.

(b) For In the event that the ~~above~~required fault clearance ~~times are~~time is not met as a result of failure to operate on the **Main Protection System(s)** provided, the **Generators** or **DC Converter Station** owners or **Generators** in the case of **OTSDUW Plant and Apparatus** shall, except as specified below, provide **Independent Back-Up Protection**. **NGET** will also provide **Back-Up Protection** and ~~these~~NGET and the User's **Back-Up Protections** will be co-ordinated so as to provide **Discrimination**.

On a **Generating Unit** (other than a **Power Park UnitsUnit**), **DC Converter** or **Power Park Module** or **OTSDUW Plant and Apparatus** in respect of which the **Completion Date** is after [Date of Approval] and connected to the **National Electricity Transmission System** at 400kV or 275 kV and where ~~only one~~ **two Independent Main Protections** are provided to clear faults on the **HV Connections** within the required fault clearance time, the **Back-Up Protection** provided by the **Generators** (including in respect of **OTSDUW Plant and Apparatus**) and **DC Converter Station** owners shall operate to give a fault clearance time of no ~~slower~~ **longer** than ~~300 ms~~ **300ms** at the minimum infeed for normal operation for faults on the **HV Connections**. ~~Where two Independent Main Protections are installed the Back-up Protection may be integrated into one (or both) of the Independent Main Protection relays.~~

~~On a **Generating Unit** (other than a **Power Park Unit**), **DC Converter** or **Power Park Module** or **OTSDUW Plant and Apparatus** in respect of which the **Completion Date** is after [Date of Approval] and connected to the **National Electricity Transmission System** at 132 kV and where only one **Main Protection** is provided to clear faults on the **HV Connections** within the required fault clearance time, the **Independent Back-Up Protection** provided by the **Generator** (including in respect of **OTSDUW Plant and Apparatus**) and the **DC Converter Station** owner shall operate to give a fault clearance time of no longer than 300ms at the minimum infeed for normal operation for faults on the **HV Connections**.~~

~~On a **Generating Unit** (other than a **Power Park Unit**), **DC Converter** or **Power Park Module** or **OTSDUW Plant and Apparatus** connected to the **National Electricity Transmission System** and on **Generating Units** (other than a **Power Park UnitsUnit**), **DC Converters** or **Power Park Modules** or **OTSDUW Plant and Apparatus** connected to the **National Electricity Transmission System** in **England and Wales** at 400 kV ~~and/or~~ 275 kV ~~where two Main Protections are provided and on **Generating Units** (other than **Power Park Units**), **DC Converters** or **Power Park Modules** or **OTSDUW Plant and Apparatus** connected to the **National Electricity Transmission System** at 132 kV and below, in respect of which the **Completion Date** is before the [Date of Approval], the **Back-Up Protection** or **Independent Back-Up Protection** shall operate to give a fault clearance time of no ~~slower than 800 ms in England and Wales or Offshore and 300 ms in Scotland~~ **longer than 800ms** at the minimum infeed for normal operation for faults on the **HV Connections**.~~~~

~~**Generators'** (including in respect of **Generating Unit** (other than a **Power Park Unit**), **DC Converter** or **Power Park Module** or **OTSDUW Plant and Apparatus**) and **DC Converter Station** owners' with **Back-Up Protection** or **Independent Back-Up Protection** will also be required to withstand, without tripping, the loading incurred during the clearance of a fault on the **National Electricity Transmission System** by breaker fail **Protection** at 400kV or 275kV or of a fault cleared by **Back-Up Protection** where the **Generator** (including in the case of **OTSDUW Plant and Apparatus**) or **DC Converter** is connected at 132kV and below. This will permit **Discrimination** between **Generator** (in respect of **OTSDUW Plant and Apparatus**) or **DC Converter Station Owners' Back-Up Protection** ~~and/or **Independent Back-Up Protection** and the **Back-Up Protection** provided on the **National Electricity Transmission System** and other **Users' Systems**.~~~~

- (c) When the **Generating Unit** (other than **Power Park Units**), or the **DC Converter** or **Power Park Module** or **OTSDUW Plant and Apparatus** is connected to the **National Electricity Transmission System** at 400kV or 275kV, and in Scotland and **Offshore** also at 132kV, and a circuit breaker is provided by the **Generator** (including in respect of **OTSDUW Plant and Apparatus**) or the **DC Converter Station** owner, or **NGET**, as the case may be, to interrupt fault current interchange with the **National Electricity Transmission System**, or **Generator's System**, or **DC Converter Station** owner's **System**, as the case may be, circuit breaker fail **Protection** shall be provided by the **Generator** (including in respect of **OTSDUW Plant and Apparatus**) or **DC Converter Station** owner, or **NGET**, as the case may be, on this circuit breaker. In the event, following operation of a **Protection** system, of a failure to interrupt fault current by these circuit-breakers within the **Fault Current Interruption Time**, the circuit breaker fail **Protection** is required to initiate tripping of all the necessary electrically adjacent circuit-breakers so as to interrupt the fault current within the next ~~200 ms~~200ms.
- (d) The target performance for the **System Fault Dependability Index** shall be not less than 99%. This is a measure of the ability of **Protection** to initiate successful tripping of circuit breakers which are associated with the faulty item of **Apparatus**.

CC.6.2.2.3 Equipment to be provided

CC.6.2.2.3.1 Protection of Interconnecting Connections

The requirements for the provision of **Protection** equipment for interconnecting connections will be specified in the **Bilateral Agreement**. In this **CC** the term "interconnecting connections" means the primary conductors from the current transformer accommodation on the circuit side of the circuit breaker to the **Connection Point** or the primary conductors from the current transformer accommodation on the circuit side of the **OTSDUW Plant and Apparatus** of the circuit breaker to the **Transmission Interface Point**.

CC.6.2.2.3.2 Circuit-breaker fail Protection

The **Generator** or **DC Converter Station** owner will install circuit breaker fail **Protection** equipment in accordance with the requirements of the **Bilateral Agreement**. The **Generator** or **DC Converter Station** owner will also provide a back-trip signal in the event of loss of air from its pressurised head circuit breakers, during the **Generating Unit** (other than a **CCGT Unit** or **Power Park Unit**) or **CCGT Module** or **DC Converter** or **Power Park Module** run-up sequence, where these circuit breakers are installed.

CC.6.2.2.3.3 Loss of Excitation

The **Generator** must provide **Protection** to detect loss of excitation on a **Generating Unit** and initiate a **Generating Unit** trip.

CC.6.2.2.3.4 Pole-Slipping Protection

Where, in **NGET's** reasonable opinion, **System** requirements dictate, **NGET** will specify in the **Bilateral Agreement** a requirement for **Generators** to fit pole-slipping **Protection** on their **Generating Units**.

CC.6.2.2.3.5 Signals for Tariff Metering

Generators and **DC Converter Station** owners will install current and voltage transformers supplying all tariff meters at a voltage to be specified in, and in accordance with, the **Bilateral Agreement**.

CC.6.2.2.4 Work on Protection Equipment

No busbar **Protection**, mesh corner **Protection**, circuit-breaker fail **Protection** relays, AC or DC wiring (other than power supplies or DC tripping associated with the **Generating Unit**, **DC Converter** or **Power Park Module** itself) may be worked upon or altered by the **Generator** or **DC Converter Station** owner personnel in the absence of a representative of **NGET** or in Scotland or **Offshore**, a representative of **NGET**, or written authority from **NGET** to perform such work or alterations in the absence of a representative of **NGET**.

CC.6.2.2.5 Relay Settings

Protection and relay settings will be co-ordinated (both on connection and subsequently) across the **Connection Point** in accordance with the **Bilateral Agreement** and in relation to **OTSDUW Plant and Apparatus**, across the **Interface Point** in accordance with the **Bilateral Agreement** to ensure effective disconnection of faulty **Apparatus**.

CC.6.2.3 Requirements at Connection Points relating to Network Operators and Non-Embedded Customers

CC.6.2.3.1 Protection Arrangements for Network Operators and Non-Embedded Customers

CC.6.2.3.1.1 **Protection of Network Operator and Non-Embedded Customers User Systems** directly ~~supplied from~~connected to the **National Electricity Transmission System**, ~~must~~shall meet the ~~minimum~~ requirements ~~referred to~~given below:

Fault Clearance Times

(a) The ~~required~~ fault clearance ~~time~~time for faults on **Network Operator** and **Non-Embedded Customer** equipment directly connected to the **National Electricity Transmission System**, and for faults on the **National Electricity Transmission System** directly connected to the **Network Operator's** or **Non-Embedded Customer's** equipment, from fault inception to the circuit breaker arc extinction, shall be set out in ~~accordance with~~ each **Bilateral Agreement**. The ~~time~~fault clearance time specified in ~~accordance with~~ the **Bilateral Agreement** shall not be ~~faster~~shorter than ~~the durations specified below~~:

- (i) ~~80ms~~80ms at 400kV
- (ii) ~~400ms~~100ms at 275kV
- (iii) ~~420ms~~120ms at 132kV and below

but this shall not prevent ~~at~~ the **User** or **NGET** ~~having a faster~~from selecting shorter fault clearance time on its own Plant and Apparatus provided Discrimination is achieved.

~~Slower~~ For the purpose of establishing the **Protection** requirements in accordance with CC.6.2.3.1.1 only, the point of connection of the **Network Operator** or **Non-Embedded Customer** equipment to the **National Electricity Transmission System** shall be deemed to be the low voltage busbars at a **Grid Supply Point**, irrespective of the ownership of the equipment at the **Grid Supply Point**.

~~A longer~~ fault clearance ~~times~~time may be specified in ~~accordance with~~ the **Bilateral Agreement** for faults on the **National Electricity Transmission System**. ~~Slower~~A longer fault clearance ~~times~~time for faults on the **Network Operator** and **Non-Embedded Customers** equipment may be agreed ~~with NGET~~ in accordance with the terms of the **Bilateral Agreement** but only if **System** requirements in **NGET's** view permit. The probability that the fault clearance ~~times~~time stated in ~~accordance with~~ the **Bilateral Agreement** will be exceeded by any given fault must be less than 2%.

- (b) (i) For the event of failure of the **Protection** systems provided to meet the above fault clearance time requirements, **Back-Up Protection** shall be provided by the **Network Operator** or **Non-Embedded Customer** as the case may be.
- (ii) **NGET** will also provide **Back-Up Protection**, which will result in a fault clearance time ~~slower~~longer than that specified for the **Network Operator** or **Non-Embedded Customer Back-Up Protection** so as to provide **Discrimination**.
- (iii) For connections with the **National Electricity Transmission System** at 132kV and below, it is normally required that the **Back-Up Protection** on the **National Electricity Transmission System** shall discriminate with the **Network Operator** or **Non-Embedded Customer's Back-Up Protection**.
- (iv) For connections with the **National Electricity Transmission System** at 400kV or 275kV, the **Back-Up Protection** will be provided by the **Network Operator** or **Non-Embedded Customer**, as the case may be, with a fault clearance time not ~~slower~~longer than ~~300ms~~300ms for faults on the **Network Operator's** or **Non-Embedded Customer's Apparatus**.
- (v) Such **Protection** will also be required to withstand, without tripping, the loading incurred during the clearance of a fault on the **National Electricity Transmission System** by breaker fail **Protection** at 400kV or 275kV. This will permit **Discrimination** between **Network Operator's Back-Up Protection** or **Non-Embedded Customer's Back-Up Protection**, as the case may be, ~~Back-Up Protection~~ and **Back-Up Protection** provided on the **National Electricity Transmission System** and other **User Systems**.- The requirement for and level of **Discrimination** required will be specified in the **Bilateral Agreement**.
- (c) (i) Where the **Network Operator** or **Non-Embedded Customer** is connected to the **National Electricity Transmission System** at 400kV or 275kV, and in Scotland also at 132kV, and a circuit breaker is provided by the **Network Operator** or **Non-Embedded Customer**, or **NGET**, as the case may be, to interrupt the interchange of fault current with the **National Electricity Transmission System** or the **System** of the **Network Operator** or **Non-Embedded Customer**, as the case may be, circuit breaker fail **Protection** will be provided by the **Network Operator** or **Non-Embedded Customer**, or **NGET**, as the case may be, on this circuit breaker.
- (ii) In the event, following operation of a **Protection** system, of a failure to interrupt fault current by these circuit-breakers within the **Fault Current Interruption Time**, the circuit breaker fail **Protection** is required to initiate tripping of all the necessary electrically adjacent circuit-breakers so as to interrupt the fault current within the next ~~200ms~~200ms.

| _____(d) The target performance for the **System Fault Dependability Index** shall be not less than 99%. This is a measure of the ability of **Protection** to initiate successful tripping of circuit breakers which are associated with the faulty items of **Apparatus**.

Proposed Changes to Glossary and Definitions

Independent Back-Up Protection	A Back-Up Protection system which utilises a discrete relay, different current transformers and an alternate operating principle to the Main Protection systems(s) such that it can operate autonomously in the event of a failure of the Main Protection .
Independent Main Protection	A Main Protection system which utilises a physically discrete relay and different current transformers to any other Main Protection .
Main Protection	A Protection system which has priority above other Protection in initiating either a fault clearance or an action to terminate an abnormal condition in a power system.
Back-Up Protection	A Protection system which will operate when a system fault is not cleared by other Protection .

6 Meeting Name Protection Specialists Grid Code Group

Meeting No.	1
Date of Meeting	20 th March 2009
Time	10:00am – 1:00pm
Venue Park	Conference Room 2, National Grid Offices, Thorpe Leeds

This note outlines the key points from the first meeting of the Protection Specialists Grid Code Group.

Members Present:

Nick Tart	NT	National Grid, Chairman
Richard Dunn	RD	Technical Secretary
Gihan Abeyawardene	GA	National Grid
Chris Smith	CS	RWE npower
Daniel Collinson	DC	Scottish and Southern
Jennie Weatherill	JW	E.On UK Ltd
John Stokoe	JS	SP Power Systems (via teleconference)
Jim Barrett	JB	Centrica (via teleconference)

Apologies:

Terry Brennan	TB	Scottish and Southern
Craig McTaggart	CM	SP Power Systems
Ken Donaghy	KD	Scottish and Southern
Paul Smith	PS	E connect

1. Introductions and Apologies

1. Apologies for absence were received from Terry Brennan, Craig McTaggart, Ken Donaghy and Paul Smith. John Stokoe was standing in For Craig McTaggart.
2. RD explained that the Grid Code Review Panel had asked that a Group of Protection Specialists should consider wording being proposed by National Grid to amend CC. 6.2.2.2.2 and CC.6.2.3.1 of the Grid Code in paper pp08/43 to ensure that the wording provided clarity
 - on the minimum fault clearance times,
 - on the minimum requirements for the application of Main and Backup Protection at the Generator's connection point to the GB transmission system

- the performance requirements of the applied Backup Protection on the Generator's point of connection.

The Group would need to report back to the Grid Code Review Panel on its findings in due course.

2. Back – up protection – Overview of Existing Grid Code provisions Obligations and Associated Issues

3. NT gave the meeting a presentation which explained the Back-up protection provisions in CC.6.2.2.2 .2 of the Grid Code relating to Back-up protection.
4. The purpose of the provision in the Code was to ensure that the Generator provided Back-Up protection for the detection of an uncleared HV Connections fault which grades effectively with NGET's Backup protection. The table in slide 2 of the presentation explained the situation provided for in CC.6.2.2.2 (b) of the Grid Code. National Grid's role in managing the Grid Code compliance process for new generators connecting to the system and ongoing compliance for existing generators has highlighted potentially inadequate discrimination between National Grid's and the Generator's Backup protection systems. It was also unclear why the Back-up Protection operational requirements were different in England and Wales (800ms) from those in Scotland (300ms) where there was double HV Connections Protection.
5. The consequences of inadequate discrimination is that in the event of a failure on the Main Protection System an uncleared HV Connections fault could result in the fault clearance by National Grid's feeder remote end Back-up Protection (typically 500ms). This would result in the loss of the local substation and the connected transmission feeder circuits from the respective remote ends.
6. CC.6.2.2.2 (b) currently therefore did not adequately clarify:
 - that the Backup Protection function has to be separate from the Main Protection;
 - that the function should be supported by a separate CT (i.e. does not share the same CT as the Main Protection);
 - under what circumstances the function may be provided as part of the Main Protection (e.g. when two Main Protections are provided);

and these issues regarding independency would need to be adequately addressed in the revised wording for CC.6.2.2.2 (b).

7. The revised proposed wording for CC.6.2.2.2 (b) therefore attempted to tackle this problem by introducing two new definitions into the Grid Code:
 - (i) **Independent Back-up Protection** – A Back-up Protection which utilises a different type of relay and different Current Transformers (CTs) from the Main Protection such that it can operate autonomously in the event of any failure of the Main Protection.

- (ii) **Independent Main Protection** – A Protection System which comprises of two or more Main Protections in which each Main Protection utilises a different type of relay and different Current Transformers (CTs) such that the Main Protections can operate autonomously from each other in the event of any failure.

The above definitions were discussed during the meeting and changes were proposed in line with the modified document.

8. The proposed wording also envisaged that for connections with a completion date of post 1st January 2009 the provision of Independent Back-up Protection is a requirement with an operating time of 300ms to ensure grading with National Grid's Feeder Back-up Protection philosophy.
9. The proposed wording also envisaged that for connections with a completion date of pre 1st January 2009, confirmation should be provided by the User that two Independent Main Protections and Back-up Protection are installed and that the Back-up Protection operating time should be no slower than 800ms.
10. The proposed application criteria for Back-up Protection to Generator HV Connections was identified as:
 - setting to act as a Back-up for a HV connections fault
 - setting to be immune to Generator to System infeed under close up system fault scenario (e.g. busbar fault or close-up fault on a outgoing feeder circuit)
 - setting to achieve operation under minimum plant conditions (summer transient fault level) for a system fed HV Connections fault
 - operate time to be set to 300ms
 - Back-up function can be provided from overcurrent elements (i.e. at EHV and 132kV). A separate earth fault element is not required.
11. National Grid identified that, due to the issues highlighted that where insufficient grading with National Grid feeder remote end backup protection (looking into the local substation) has been identified certain connections completed before 1st January 2009 may require remedial work to ensure that a suitable backup protection grading is established. National Grid proposed the following criteria for assessing whether remedial work would be required at such sites:

Category/ Main Prot	Main Prot OEM/type	Backup Prot	CT Provision	Operate Time (at min plant)	Action Required?
1 - One	-	none	-	-	Yes
2 - One	-	Integral to main	-	-	Yes
3 - One	-	Separate Backup Relay	Shared	-	Yes
4 - One	-	Separate Backup Relay	Separate CTs	>300ms	Yes
5 - One	-	Separate Backup Relay	Separate CTs	<_300ms	No
6 - Two	Same OEM/numerical	none	MPs share same CT	-	Yes
7 - Two	Same OEM/numerical	none	MPs have separate CTs	-	Yes

8 - Two	Different OEM/numerical	none	MPs have separate CTs	-	Yes (enable BU in each)
9 - Two	Same OEM/numerical	BU integral to main	MPs have separate CTs	> 300ms	Yes
10 - Two	Same OEM/numerical	Separate Backup Relay	MPs have separate CTs	> 300ms	Yes
11 - Two	Electromech	Separate Backup Relay	MPs CTs separate to BU CTs	<_ 800ms	No

12. The Group were invited to comment on these criteria for identifying the protection arrangements in place and whether remedial action was required. JS noted that the Backup protection setting in SP's area was generally 400ms which would need to be considered as part of any solution to the issue. JS also referred to the comment made by CM prior to the meeting in his e-mail dated 12th March that a definite time setting may compromise the grading on the Generator's own system. GA noted CM's comments but suggested that Grid Code was only considering arrangements for Backup protection in the event of HV connection faults and thus such arrangements should be immune to Generator fed System faults. He agreed however that a primary operate current setting satisfying the requirements as listed in 10 above may not be able to meet all the fault level scenarios.
13. CS noted that categories 1+ 4 would already be in breach of the existing Grid Code. There might be some sites under categories 2+3. NT indicated that National Grid had undertaken a desktop survey of a cross section of Generator connections from its own records to determine whether there were any sites in this category and none were highlighted.
14. CS noted that the new definition of Independent Main Protection proposed by National Grid was insufficiently robust where it referred to "... A different type of relay...". Re-drafting on the lines of "... Separate relay in a different relay function ..." Would be necessary. NT thanked CS for this input and agreed to reconsider that particular wording.
15. In response to a question from DC relating to who would bear the costs of any additional relays to ensure adequate independence of Backup protection arrangements, NT indicated that National Grid's approach was to try and avoid any retrospection in the outcome and concentrate on ensuring compliance moving forward but also to identify and rectify any existing high risk installations.. National Grid would continue to refine the table illustrating the various categories of Backup protection and employ a more risk based approach depending on the likelihood of an incident under the category in assessing whether the category needed to be catered for in the Grid Code wording. The tables would be produced in Word format.
16. During discussion it was agreed that the following changes could be made to the proposed wording attached to pp08/43:
1. Modify the wording in clause CC6.2.2.2 (b) to clarify the application requirements of Backup Protection in context with the nature of the provision of Main Protection
 2. "Longer" should come back in to the drafting rather than "shorter".
 3. Amend the proposed definitions of "Independent Main Protection" to duplicate and "Independent Main Protection" to refer to "discrete" relays rather than the existing wording
 4. Amend the proposed definition for Independent Backup Protection to define a relay that is a discreet relay with an alternate protection philosophy to the Main protection.

Please refer to attached proposed wording documents for the above mentioned changes.

17. During discussion potential changes were also identified that required further assessment before the wording could be developed. These were:
 1. In CC.6.2.2.2.2 (b) second paragraph the wording after “For the avoidance of doubt ...” required review. GA offered to review this in due course.
 2. Need to ensure that the wording in the definitions also works for a numerical relay and make clear that the protection is required in addition to that for any circuit breaker failure in isolation.
 3. The wording would need to be assessed in due course in terms of whether it worked for the configurations on the ground (in the context of any retrospection)
 4. Consider the need for references to SP and SHETL in the wording in due course.
 5. In CC.6.2.2.2.2 (c) it was proposed to modify the final sentence to say “....as to interrupt the fault current to give an overall fault clearance no longer than 300mS.
 6. In CC.6.2.3.1.1 how do we deal with the fact that fault clearance times at 33kV (which can be transmission) and below in Scotland are not shorter than 200ms? However it was noted that the Grid Code is not currently at voltages below 132kV and this would need to be considered under a wider Grid Code review.

3. Next Steps

18. It was agreed that National Grid would provide the table (in Word format) analysing any need for remedial work depending on the protection configuration to Members of the Group by mid-May. Group Members would then consider whether there was any need to capture additional categories in the table and also begin a survey of generation sites to establish which sites fell into which protection category and provide this to National Grid in due course. This survey was expected to take several months.

Action: NT/All relevant Group Members

19. National Grid would continue to refine the proposed Grid Code drafting attached to pp08/43 in discussion with Group Members. The wording is attached for review. However it is acknowledged that the wording may need to be revisited in the light of the outcome of the survey of sites to ensure that it was fit for purpose.

Action: NT/GA

4. Date of Next Meeting

20. It was agreed that the next meeting of the Group would be arranged for September 2009 when the Generators had been able to survey the protection arrangements at their sites and provide feedback to National Grid who would then analyse the extent of the actions required overall.

Action: NT/GA