RfG

Governor Deadband / Insensitivity Test Procedure

[Insert Unit Name]

[Insert Three Letter Code]

Version 0.1



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# IPP TEST PROCEDURE vERSION History

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Document Revsion History** | | | | |
| **Revision** | **Date** | **Comment** | **Name** | **Company** |
| 0.1 | Xx/xx/xxxx | XX | User | User |
|  |  |  |  |  |
| 1.0 | Xx/xx/xxxx | Revised to Major version for onsite testing and signoff |  | EirGrid |

# Introduction

The Unit must submit the latest version of this test procedure as published on the EirGrid or SONI website[[1]](#footnote-1).

All yellow sections must be filled in before the test procedure will be approved. All grey sections must be filled in during testing. If any test requirements or steps are unclear, or if there is an issue with meeting any requirements or carrying out any steps, please contact [generator\_testing@eirgrid.com](mailto:generator_testing@eirgrid.com).

On the day of testing, suitably qualified technical personnel are required on site to assist in undertaking the tests. The personnel shall have the ability to:

1. Set up and disconnect the control system and instrumentation as required;
2. Ability to fully understand the Unit’s function and its relationship to the System;
3. Liaise with NCC/CHCC as required;
4. Mitigate issues arising during the test and report on system incidents.

The availability of personnel at NCC/CHCC will be necessary in order to initiate the necessary instructions for the test. NCC/CHCC will determine:

1. If network conditions allow the testing to proceed.
2. Which tests will be carried out?
3. When the tests will be carried out.

On completion of this test, the following shall be submitted to [generator\_testing@eirgrid.com](mailto:generator_testing@eirgrid.com):

|  |  |
| --- | --- |
| **Submission** | **Timeline** |
| A scanned copy of the test procedure, as completed and signed on site on the day of testing | 1 working day |
| Test data in CSV or Excel format | 1 working day |
| Test report | 10 working days |

# Abbreviations

NCC National Control Centre

CHCC Castlereagh House Control Centre

HV High Voltage

MEC Maximum Export Capacity

MVAr Mega Volt Ampere – reactive

MW Mega Watt

MCR Maximum Continuous Rating

TSO Transmission System Operator

EDIL Electronic Dispatch Instruction Logger

RPM Revolutions per minute

# Unit DATA

|  |  |
| --- | --- |
| Unit Test Coordinator | Unit to Specify Name, Company and contact details. |
| Unit name | Unit to Specify |
| Associated 110 kV Station | Unit to Specify |
| Unit connection point | Unit to Specify |
| Unit connection voltage | Unit to Specify |
| Unit Fuel Type: | Primary Fuel / Secondary Fuel, Gas / Distillate |
| Registered Capacity / Maximum Continuous Rating | Unit to Specify |
| Contracted MEC | Unit to Specify |
| Installed Plant | Unit to Specify |
| Minimum Load | Unit to Specify |
| 75% of Registered Capacity | Unit to Specify |

# EirGrid Grid Code References

|  |  |
| --- | --- |
| Grid Code Version: | Unit to specify |

CC.7.5.8.4 The **Frequency Deadband** for all **Interconnectors** should be no greater than 0.03Hz (for the avoidance of doubt, ±0.015Hz);

**OC.4.3.4.1.5 Frequency Sensitive Mode**

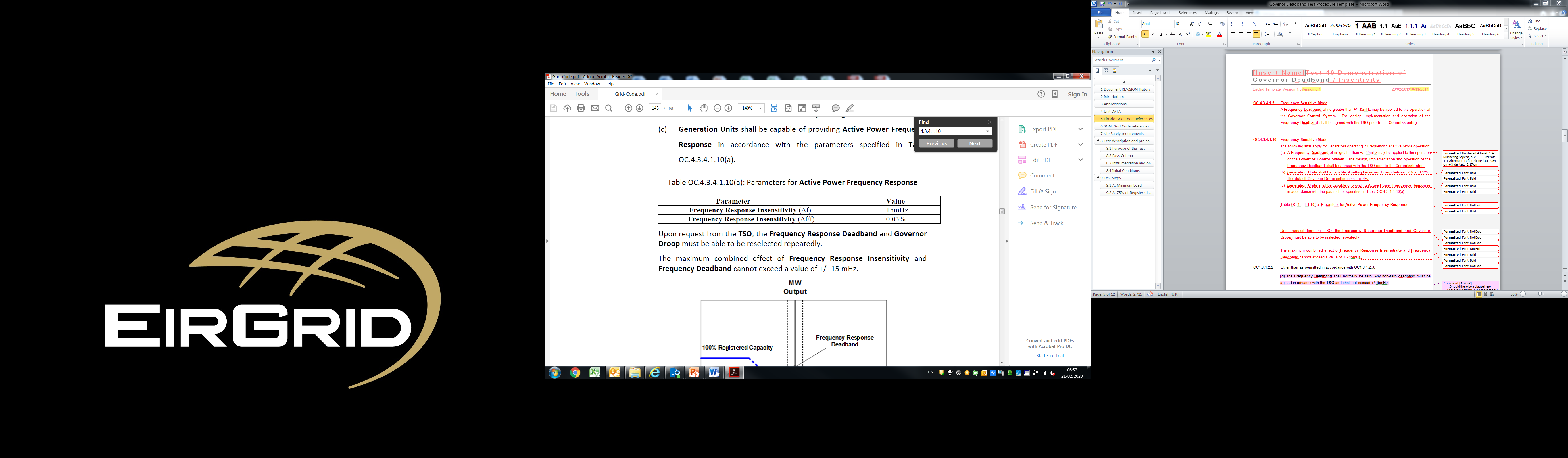
A **Frequency Deadband** of no greater than +/- 15mHz may be applied to the operation of the **Governor Control System**. The design, implementation and operation of the **Frequency Deadband** shall be agreed with the **TSO** prior to the **Commissioning**.

**OC.4.3.4.1.10 Frequency Sensitive Mode**

The following shall apply for Generators operating in Frequency Sensitive Mode operation:

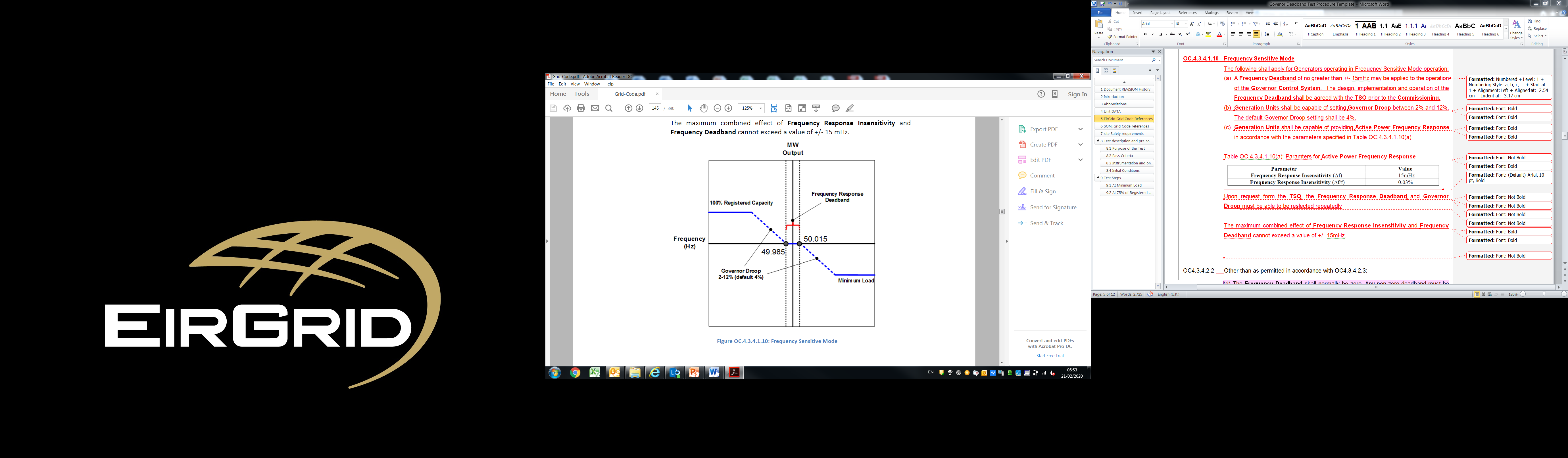
1. A **Frequency Deadband** of no greater than +/- 15mHz may be applied to the operation of the **Governor Control System**. The design, implementation and operation of the **Frequency Deadband** shall be agreed with the **TSO** prior to the **Commissioning**.
2. **Generation Units** shall be capable of setting **Governor Droop** between 2% and 12%. The default Governor Droop setting shall be 4%.
3. **Generation Units** shall be capable of providing **Active Power Frequency Response** in accordance with the parameters specified in Table OC.4.3.4.1.10(a)

Table OC.4.3.4.1.10(a); Paramters for **Active Power Frequency Response**



Upon request form the **TSO**, the **Frequency Response Deadband** and **Governor Droop** must be able to be reslected repeatedly

The maximum combined effect of **Frequency Response Insensitivity** and **Frequency Deadband** cannot exceed a value of +/- 15mHz.



OC4.3.4.2.2 Other than as permitted in accordance with OC4.3.4.2.3:

(d) The **Frequency Deadband** shall normally be zero. Any non-zero deadband must be agreed in advance with the **TSO** and shall not exceed +/-15mHz.

**Glossary:**

|  |  |
| --- | --- |
| **Frequency Deadband** | A **Frequency** range within which the **Governor Control System** is not expected to respond to changes in **Transmission System Frequency**. The purpose of the **Frequency Deadband** is to filter  out noise and not to restrict the normal **Frequency** response of the **Governor Control System**. |
| **Frequency** | The number of alternating current cycles per second (expressed in Hertz) at which a **System** is running. |
| **Governor Control System** | A system which will result in **Active Power** output of a **Generation Unit** changing, in response to a change in **System Frequency**, in a direction which assists in the recovery to **Target Frequency** |

Delete references to Interconnector or Generator as appropriate.

1. **SONI Grid Code references**

|  |  |
| --- | --- |
| Grid Code Version: | Unit to specify |

CC.S1.1.5.1 Each **Generating Unit** must be capable, in accordance with CC.S1.1.5.2 and CC.S1.1.5.3, of contributing appropriately, as reasonably specified by the **TSO**, to

**Frequency** and voltage control by continuous modulation of **Active Power** and **Reactive Power** supplied to the **Transmission System**.

CC.S1.1.5.2 Each **Generating Unit** with a **Registered Capacity** of 5 **MW** or more must be fitted with a fast acting proportional turbine speed governor to provide **Frequency Control** under normal operational conditions as specified by the **TSO** in the relevant **Connection Agreement**. Where a **Generating Unit** or **Power Station** becomes isolated from the rest of the **Transmission System** but is still supplying **Customers**, the speed governor must also be able to contribute to controlling **NI System** **Frequency** to below 52 Hz. As stated in CC5.3.2, the **NI System Frequency** could rise to 52 Hz or fall to 47 Hz. For steam turbine **Generating Units** the governor must be designed and operated to the relevant requirements of BS132. For gas turbine **Generating Units** the governor must be capable of operating with a nominal droop characteristic of 4%.

**Guidance for the Exchange of Data and for Testing of New or Modified Generation Connected to the all island Transmission System**

**6.5 GOVERNOR RESPONSE**

**Criteria of Assessment:**

**-** Governor dead-band +/-0.015Hz.

**Glossary:**

|  |  |
| --- | --- |
| **Frequency Control** | The control of the **Frequency** on the **Total System** |
| **Unit Load Controller** | A device which regulates the generation level when the **Generating Unit** is operating in **Frequency Sensitive Mode** to ensure (as far as possible) that it does not exceed or fall short of previously set limits. |

# site Safety requirements

The following is required for the EirGrid/SONI witness to attend site:

|  |  |
| --- | --- |
| Personal Protective Equipment Requirements   1. Site Safety boots 2. Hard Hat with chin strap 3. Hi Vis 4. Arc Resistive clothing 5. Safety Glasses 6. Gloves 7. Safe Pass | 1. Yes / No 2. Yes / No 3. Yes / No 4. Yes / No 5. Yes / No 6. Yes / No 7. Yes / No |
| Site Induction requirements | Yes / No  (If Yes, Unit to specify how and when the induction must carried out) |
| Any further information | Unit to specify |

# Test description and pre conditions

## Purpose of the Test

The aim of the test is to measure the governors Deadband characteristic with frequency response on.

This may be achieved either by injecting a series of step changes into the frequency input to the governor or, by injection, ramping the frequency input to the governor from one side of the deadband through 50 Hz and out through the other side of the frequency deadband (e.g. ramping from 50.05 Hz through to 49.05 Hz ).

In both cases it is recommended to isolate the system frequency from the governor for the purposes of this test as variation in system frequency, in addition to the injected frequency, may make the determination of the deadband difficult.

## Pass Criteria

The following is the pass criteria for the test. Any subsequent report for this test will be assessed against each of these criteria.

1. The governor Deadband is demonstrated to be no greater than +/- 15 mHz.
2. The governor deadband characteristic is to be recorded.

## Instrumentation and onsite data trending

All of the following trends and screenshots must be recorded by the Unit during the test. Failure to provide any of these trends will result in test cancellation.

|  |  |  |  |
| --- | --- | --- | --- |
| **No.** | **Data Trending and Recording** | **Resolution** | **Source** |
| 1 | Active power at Connection (MW) | Unit to specify, 100ms or as agreed with TSO | Unit to specify |
| 2 | Reactive power at Connection point (MW) | Unit to specify, 100ms or as agreed with TSO | Unit to specify |
| 3 | Active Power at Generator Terminals (MW) | Unit to specify, 100ms or as agreed with TSO | Unit to specify |
| 4 | Reactive Power at Generator Terminals (Mvar) | Unit to specify, 100ms or as agreed with TSO | Unit to specify |
| 5 | Generator Voltage (kV) | Unit to specify, 100ms or as agreed with TSO | Unit to specify |
| 6 | Turbine Speed (RPM) | Unit to specify, 100ms or as agreed with TSO | Unit to specify |
| 7 | Generator Transformer Tap setting | Unit to specify, 100ms or as agreed with TSO | Unit to specify |
| 8 | System Voltage | Unit to specify, 100ms or as agreed with TSO | Unit to specify |
| 9 | Generator Frequency (Hz) | Unit to specify, 100ms or as agreed with TSO | Unit to specify |
| 10 | Simulated Frequency (Hz) | Unit to specify, 100ms or as agreed with TSO | Unit to specify |
| 12 | Other signals as required by the unit or by [generator\_testing@eirgrid.com](mailto:generator_testing@eirgrid.com). | Unit to specify, 100ms or as agreed with TSO | Unit to specify |
| 13 | Alarm/Event page | Screenshot alarms/events for duration of the test. | |
| 14 | Generator Overview Screen | Screenshot where required. I.e. where information is not available through the trending above. | |
| 15 | EDIL instructions | Screenshot as logged during the test. | |

## Initial Conditions

Should “No” be answered to any of the following, contact EirGrid/SONI Test Coordinator and agree next steps in advance of making any corrective actions.

|  |  |  |
| --- | --- | --- |
| **No.** | **Conditions** | **Check on day of test** |
| 1 | Test Profiles have been submitted and approved by [neartime@eirgrid.com](mailto:neartime@eirgrid.com). | Yes/No |
| 2 | Unit Fuel Type: Primary Fuel / Secondary Fuel, Gas / Distillate.  Interconnector operation direction: Import / Export.  Delete references to Interconnector or Generator as appropriate. | Yes/No |
| 3 | Correction curves (Temperature, humidity, atmospheric pressure) have been provided to [generator\_testing@eirgrid.com](mailto:generator_testing@eirgrid.com). | Yes/No |
| 4 | Frequency Response mode On | Yes/No |
| 5 | Unit is on load and stable in agreement with NCC/CHCC. | Yes/No |
| 6 | Normal start up support auxiliary systems are in service. | Yes/No |
| 7 | Required signals, as described in section 8.3 are available. | Yes/No |

# Test Steps

## At Minimum Load

|  |  |  |  |
| --- | --- | --- | --- |
| **Step No.** | **Action** | **Time** | **Comments** |
| 1 | Unit operator begins data recording for all trends noted in Section 8.3. |  |  |
| 2 | Unit operator contacts NCC/CHCC and requests permission to begin test and a dispatch instruction to **Minimum Load** via EDIL. |  | Minimum Load \_\_\_\_\_MW |
| 3 | Unit operator receives EDIL instruction, dispatches the Unit to Minimum Load and allows the Unit to stabilise for 30 minutes or as required. |  |  |
| 4 | Inject a test signal to the governor control as a step input with a value of **50.014Hz** and maintain this signal for a period of 60 seconds. |  |  |
| 5 | Inject a test signal to the governor control as a step input with a value of **50.015Hz** and maintain this signal for a period of 60 seconds. |  |  |
| 6 | Inject a test signal to the governor control as a step input with a value of **50.016Hz** and maintain this signal for a period of 60 seconds. |  |  |
| 7 | Inject a test signal to the governor control as a step input with a value of **50.017Hz** and maintain this signal for a period of 60 seconds. |  |  |
|  | *Insert steps until edge of the deadband is determined and restore the injection to 50 Hz* |  |  |
| 8 | Inject a test signal to the governor control as a step input with a value of **49.983Hz** and maintain this signal for a period of 60 seconds. |  |  |
| 9 | Inject a test signal to the governor control as a step input with a value of **49.984Hz** and maintain this signal for a period of 60 seconds. |  |  |
| 10 | Inject a test signal to the governor control as a step input with a value of **49.985Hz** and maintain this signal for a period of 60 seconds. |  |  |
| 11 | Inject a test signal to the governor control as a step input with a value of **49.986Hz** and maintain this signal for a period of 60 seconds. |  |  |
| 12 | *Insert steps until edge of the deadband is determined and restore the injection to 50 Hz* |  |  |
| 13 | Unit Operator contacts NCC/CHCC, notifies them that the test is complete and follows instruction. |  | Instruction from NCC/CHCC\_\_\_\_\_\_\_\_\_\_\_ |
|  | Unit operator ends data recording for all trends noted in Section 8.3. |  |  |

## At 75% of Registered Capacity

|  |  |  |  |
| --- | --- | --- | --- |
| **Step No.** | **Action** | **Time** | **Comments** |
| 1 | Unit operator begins data recording for all trends noted in Section 8.3. |  |  |
| 2 | Unit operator contacts NCC/CHCC and requests permission to begin test and a dispatch instruction to **75% of Registered Capacity** via EDIL. |  | 75% of Registered Capacity \_\_\_\_\_MW |
| 3 | Unit operator receives EDIL instruction, dispatches the Unit to 75% of Registered Capacity and allows the Unit to stabilise for 30 minutes or as required. |  |  |
| 4 | Inject a test signal to the governor control as a step input with a value of **50.014Hz** and maintain this signal for a period of 60 seconds. |  |  |
| 5 | Inject a test signal to the governor control as a step input with a value of **50.015Hz** and maintain this signal for a period of 60 seconds. |  |  |
| 6 | Inject a test signal to the governor control as a step input with a value of **50.016Hz** and maintain this signal for a period of 60 seconds. |  |  |
| 7 | Inject a test signal to the governor control as a step input with a value of **50.017Hz** and maintain this signal for a period of 60 seconds. |  |  |
|  | *Insert steps until edge of the deadband is determined and restore the injection to 50 Hz* |  |  |
| 8 | Inject a test signal to the governor control as a step input with a value of **49.983Hz** and maintain this signal for a period of 60 seconds. |  |  |
| 9 | Inject a test signal to the governor control as a step input with a value of **49.984Hz** and maintain this signal for a period of 60 seconds. |  |  |
| 10 | Inject a test signal to the governor control as a step input with a value of **49.985Hz** and maintain this signal for a period of 60 seconds. |  |  |
| 11 | Inject a test signal to the governor control as a step input with a value of **49.986Hz** and maintain this signal for a period of 60 seconds. |  |  |
| 12 | *Insert steps until edge of the deadband is determined and restore the injection to 50 Hz* |  |  |
| 13 | Unit Operator contacts NCC/CHCC, notifies them that the test is complete and follows instruction. |  | Instruction from NCC/CHCC\_\_\_\_\_\_\_\_\_\_\_ |
|  | Unit operator ends data recording for all trends noted in Section 8.3. |  |  |

|  |
| --- |
| **Comments:** |
| Unit Witness signoff that this test has been carried out according to the test procedure above.  Signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date / Time: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| EirGrid/SONI Witness signoff that this test has been carried out according to the test procedure above.  Signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date / Time: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

1. <http://www.eirgrid.com/operations/gridcode/compliancetesting/cdgutestprocedures/#d.en.17699> [↑](#footnote-ref-1)