RfG

Operation at High and Low Frquency

[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 |

1. **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)..

This test is normally carried out in conjunction with Full Load Rejection followed by island mode operation. A separate test procedure and report is required for Full Load Rejection.

On the day of testing, suitably qualified technical personnel will be needed at the Unit 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.

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.

In addition, the availability of personnel at NCC/CHCC will be necessary in order to initiate the necessary instructions for the test.

Following testing, 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

MEC Maximum Export Capacity

MVAr Mega Volt Ampere – reactive

MW Mega Watt

TSO Transmission System Operator

TAO Transmission Asset Owner

Hz Hertz

# Unit DATA

|  |  |
| --- | --- |
| Unit Test Coordinator | Unit to Specify Name, Company and contact details. |
| Unit name | Unit to Specify |
| Unit connection point | Unit to Specify |
| Unit connection voltage (kV) | Unit to Specify |
| Unit Fuel Type: | Primary Fuel / Secondary Fuel, Gas / Distillate. |
| Registered Capacity (MW) | Unit to Specify |
| House Load (MW) | Unit to Specify |
| Contracted MEC (MW) | Unit to Specify |
| Installed Plant | Unit to Specify |

# Eirgrid Grid Code references

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

CC7.3.1.1Each **Generation Unit,** shall, as a minimum, have the following capabilities:

For all applicable **Generation Units**:

b) remain synchronised to the **Transmission System** at **Transmission System Frequencies** within the range 47.5Hz to 52Hz for a duration of 60 minutes.

CC.7.3.1.1.w Remain synchronised to the **Transmission System** and operate within the frequency ranges and time periods specified in Table CC.7.3.1.1.

Table CC.7.3.1.1: Minimum Time Periods for Generation Units to Remain Operational without Disconnecting

|  |  |
| --- | --- |
| **Frequency Range** | **Time Period** |
| 47 – 47.5 Hz | 20 seconds |
| 47.5 – 48.5 Hz | 90 minutes |
| 48.5 – 49 Hz | 90 minutes |
| 49 – 51 Hz | Unlimited |
| 51 – 51.5 Hz | 90 minutes |
| 51.5 – 52 Hz | 60 minutes |

**Glossary:**

|  |  |
| --- | --- |
| **Auxiliaries** | Any item of **Plant** and/or **Apparatus** not directly a part of the boiler plant or **Generating Unit**, but required for the boiler plant's or **Generating Unit's** functional operation. 'Auxiliary' shall be defined accordingly. |
| **Auxiliary Load** | The electrical **Demand** of the **Generation Unit’s Auxiliary Plant** required for the operation of the **Generation Unit**. |
| **Auxiliary Plant** | Any item of **Plant** and/or **Apparatus** not directly a part of the boiler plant or **Generation Unit**, but required for the boiler plant's or **Generation Unit's** functional operation. |
| **Frequency** | The number of alternating current cycles per second (expressed in Hertz) at which a **System** is running. |
| **System** | Any **User System** and/or the **Transmission System** as the case may be. |
| **Transmission System** | The **System** consisting (wholly or mainly) of high **Voltage** electric lines and cables operated by the **TSO** for the purposes of transmission of electricity from one **Power Station** to a sub-station or to another **Power Station** or between sub-stations or to or from any **External Interconnection** including any **Plant** and **Apparatus** and meters owned or operated by the **TSO** or **TAO** in connection with the transmission of electricity. |

# SONI grid code references

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

CC.S1.1.3.4/

CC.S1.2.3.1 A **Generating Unit** must be capable of continuously supplying its **Registered Capacity** at a stable **Output** within the **System Frequency** range 49.5 Hz to 50.5 Hz.Within the **Frequency** range 49.5 Hz to 50.5 Hz there must be no reduction in **Output** whilst **Frequency** is falling. Any decrease in **Output** whilst **Frequency** is falling to alevel below **Registered Capacity** occurring in the **Frequency** range 49.5 Hz to 47 Hzmust not be more than pro rata with any decrease below nominal **Frequency**.

CC5.3 **Frequency** Variations

CC5.3.1 The **Frequency** of the **NI System** shall be nominally 50 Hz and shall normally be controlled within the limits of 49.5

CC5.3.2 In exceptional circumstances, **System Frequency** could rise to 52 Hz or fall to 47 Hz but sustained operation outside the range specified in the Electricity Supply Regulations (N.I.) 1991 is not envisaged. **Users** should take these factors into account in the design of **Plant** and **Apparatus**.

**Glossary:**

|  |  |
| --- | --- |
| **Frequency** | The number of alternating current cycles per second (expressed in Hertz) at which a **System** is running. |
| **NI System** | Together, the **Transmission System** and the **Distribution System.** |

# 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 Descriptions and Pre Conditions

## Purpose of the Test

The purpose of this test is to demonstrate that the Unit can operate stably at both the upper and lower frequency limits as required by the Grid Code.

As it is not practicable to operate the power system at 52 Hz or 47 Hz this test is performed with the unit in the full speed no load condition.

The upper and lower frequencies to be demonstrated may include a margin to prevent the generator protection from unwanted operation.

This test shall be demonstrated on Primary and Secondary fuels.

## Pass Criteria

1. The Unit can remain operating at 47Hz to 52Hz for duration of 30 minutes at each frequency.

## 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 | Transformer Tap position | Unit to specify, 100ms or as agreed with TSO | Unit to specify |
| 8 | Generator Field Voltage | Unit to specify, 100ms or as agreed with TSO | Unit to specify |
| 9 | Generator Field Current | Unit to specify, 100ms or as agreed with TSO | Unit to specify |
| 10 | Stator temperatures | Unit to specify, 100ms or as agreed with TSO | Unit to specify |
| 11 | Rotor Temperature | Unit to specify, 100ms or as agreed with TSO | Unit to specify |
| 12 | Turbine / Generator Vibration | Unit to specify, 100ms or as agreed with TSO | Unit to specify |
| 13 | System Voltage | Unit to specify, 100ms or as agreed with TSO | Unit to specify |
| 14 | System Frequency | Unit to specify, 100ms or as agreed with TSO | Unit to specify |
| 15 | Ambient Conditions:   1. Temperature (ºC) 2. Pressure (mbar) 3. Humidity (%) | Unit to specify, 100ms or as agreed with TSO | Unit to specify |
| 16 | Other signals as required by the unit or by [generator\_testing@eirgrid.com](mailto:generator_testing@eirgrid.com). | Unit to specify | Unit to specify |
| 17 | Alarm/Event page | Screenshot alarms / events for duration of the test. | |
| 18 | Screen Shots:   1. Generator Overview 2. Generator Electrical process 3. GT process 4. Generator temperature process 5. Electrical operation | Screenshot at appropriate milestones during the test i.e. Before, during at regular intervals and after test from DCS. | |
| 19 | 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 | Frequency Response mode On | Yes/No |
| 4 | Excitation system in AVR mode | Yes/No |
| 5 | Unit is operating at full load in agreement with NCC for at least **1 hour** before test | Yes/No |
| 6 | Normal start up support auxiliary systems are aligned and in service. | Yes/No |
| 7 | Required signals, as described in section 8.3 are available. | Yes/No |

# Test Steps

|  |  |  |  |
| --- | --- | --- | --- |
| **Step No.** | **Action** | **Time** | **Comment** |
| 1 | Unit Operator begins data recording for all trends noted in Section 8.3. |  |  |
| 2 | Unit requests permission from NCC/CHCC to de-synchronise. |  |  |
| 3 | Unit disconnects from the Grid by opening High Voltage Circuit Breaker at XXXXXX substation. |  |  |
| 4 | Verify the Unit has stabilised at house load. |  |  |
| 5 | Decrease the speed of the unit to 47Hz and maintain for a period of 20 seconds. |  | Start time: \_\_\_\_\_\_.  End time; \_\_\_\_\_\_\_. |
| 6 | Increase the speed of the Unit to 47.51 Hz and maintain for a period of 9**0 minutes**. |  | Start time: \_\_\_\_\_\_.  End time; \_\_\_\_\_\_\_. |
| 7 | Increase the speed of the Unit to 51.49 Hz and maintain for a period of 9**0 minutes**. |  | Start time: \_\_\_\_\_\_.  End time; \_\_\_\_\_\_\_. |
| 8 | Increase the speed of the Unit to 52 Hz and maintain for a period of 60 **minutes**. |  | Start time: \_\_\_\_\_\_.  End time: \_\_\_\_\_\_\_. |
| 9 | Unit requests permission from NCC/CHCC to synchronise and requests dispatch Instruction via EDIL to minimum load. |  |  |
| 10 | Synchronise the Unit and load to minimum load. |  | Time to Synchronise: \_\_\_\_\_ minutes.  Time from Synchronisation to Minimum load: \_\_\_\_\_.minutes. |
| 11 | Unit ends data recording. |  |  |
| 12 | Unit informs NCC/CHCC that test is complete. |  |  |

|  |
| --- |
| **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.eirgridgroup.com/library> [↑](#footnote-ref-1)