Operation at High and Low Generator Voltages

[Insert Unit Name]

[Insert Three Letter Code]

Version 0.1



Contents

[1 Document Revision History 2](#_Toc2606263)

[2 Introduction 3](#_Toc2606264)

[3 Abbreviations 3](#_Toc2606265)

[4 Unit DATA 3](#_Toc2606266)

[5 Eirgrid Grid Code references 4](#_Toc2606267)

[6 SONI Grid Code references 5](#_Toc2606268)

[7 site Safety requirements 6](#_Toc2606269)

[8 Test Descriptions and Pre Conditions 6](#_Toc2606270)

[8.1 Purpose of the Test 6](#_Toc2606271)

[8.2 Pass Criteria 6](#_Toc2606272)

[8.3 Instrumentation and Onsite Data Trending 6](#_Toc2606273)

[9 Test Steps 8](#_Toc2606274)

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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.

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:

|  |  |
| --- | --- |
| **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

CHCC Castlereagh House Control Centre

MEC Maximum Export Capacity

MVAr Mega Volt Ampere – reactive

MW Mega Watt

NCC National Control Centre

TSO Transmission System Operator

EDIL Electronic Dispatch Instruction Logger

DCS Distributed Control System

# 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 |

# Eirgrid Grid Code references

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

CC.7.3.6 **Reactive Power** capability

CC.7.3.6.1 Each **Generation Unit** shall have the following **Reactive Power** capability as measured at their alternator terminals:

|  |  |  |  |
| --- | --- | --- | --- |
| **Voltage** Range | Connected at: | At **Registered Capacity** between: | At 35% **of Registered Capacity** between: |
|

|  |
| --- |
| 99kV ≤ **V** ≤ 123kV |

 | 110kV  | 0.93 power factor leading to 0.85 power factor lagging  | 0.7 power factor leading to 0.4 power factor lagging  |
| 85kV ≤ **V** < 99kV  | Unity power factor to 0.85 power factor lagging  | 0.7 power factor leading to 0.4 power factor lagging  |
| 200kV ≤ **V** ≤ 245kV  | 220kV  | 0.93 power factor leading to 0.85 power factor lagging  | 0.7 power factor leading to 0.4 power factor lagging  |
| 190kV ≤ **V** < 200kV  | Unity power factor to 0.85 power factor lagging  | 0.7 power factor leading to0.4 power factor lagging  |
| 360kV ≤ **V** ≤ 420kV  | 400kV  | 0.93 power factor leading to 0.85 power factor lagging  |

|  |
| --- |
| 0.7 power factor leading to 0.4 power factor lagging  |

 |
| 350kV ≤ **V** < 360kV  | Unity power factor to 0.85 power factor lagging  | 0.7 power factor leading to 0.4 power factor lagging  |

CC.7.3.6.2 At between **Registered Capacity** and 35% **Registered Capacity**, Mvar capability to be not less than indicated by a straight line drawn between the two points derived from the above, on a plot of Mvar capability against MW output.

CC.7.3.6.3 At below 35% **Registered Capacity**, Mvar capability to be not less than that at 35% **Registered Capacity**.

CC.7.3.6.4 The **Generator Transformer** shall be designed such that the **Reactive Power** capability is possible over the full range of **Transmission System** **Voltages** (specified in CC.7.3.6.1).

Glossary:

|  |  |
| --- | --- |
| **Active Power** | The product of the components of alternating current and voltage that equate to true power which is measured in units of watts and standard multiples thereof. |
| **Auxiliary Load** | The electrical **Demand** of the **Generation Unit’s Auxiliary** Plant required for the operation of the **Generation Unit.** |
| **Generation Unit Output**  | The **Active Power and Reactive Power** produced by a **Generation Unit** net of **Generation Unit Auxiliary Load**  |
| **Reactive Power**  | Means the product of voltage and current and the sine of the phase angle between them measured in units of volt-amperes reactive and standard multiples thereof.  |
| **Mvar Output**  | The **Reactive Power** produced or absorbed by a **Generation Unit** net of **Generation Unit Auxiliary Load**  |

# SONI Grid Code references

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

# site Safety requirements

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

|  |  |
| --- | --- |
| Personal Protective Equipment Requirements1. 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 the test is to demonstrate the MW capability of the generator at minimum and maximum generator voltage.

## 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 Unit power output shall be within the required band.

## 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 | System Frequency | 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. | Unit to specify | Unit to specify |
| 13 | Alarm/Event page | Screenshot alarms / events for duration of the test.  |
| 14 | Generator Overview Screen | Screenshot at appropriate milestones during the test i.e. Before, during at regular intervals and after test from generator overview page on DCS |
| 15 | EDIL instructions | Screenshot as logged during the test. |

**8.4 Initial Conditions**

Should “No” be answered to any of the following, contact the 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. | 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. | Yes/No |
| 4 | Frequency Response mode On / Off. | Yes/No |
| 5 | Unit is on load and stable in agreement with NCC/CHCC. | 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 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 **Registered Capacity** via EDIL. |  | Registered Capacity: \_\_\_\_ MW |
| 3 | Unit operator receives EDIL instruction, dispatches the Unit to **Registered Capacity** and allows the Unit to stabilise for 10 minutes. |  |  |
| 4 | Adjust the generator terminal voltage to 105% rated. |  | 105% rated voltage: \_\_\_\_\_ kV |
| 5 | With theUnit at Registered Capacity and the Generator terminal voltage at 105% rated adjust the Mvars to the rated value for Lagging Mvars on the Generator Capability Curve and allow it to thermally stabilise. |  |  |
| 6 | With the Unit at Registered Capacity and the generator thermally stabilised, run for an additional 30 minutes and record all data. |  |  |
| 7 | With the Unit at Registered Capacity adjust the PF to unity. |  |  |
| 8 | Adjust the generator terminal voltage to 95% rated.  |  | 95% rated voltage: \_\_\_\_\_kV |
| 9 | With theUnit at Registered Capacity and the Generator terminal voltage at 95% rated adjust the Mvars to the rated value for Lagging Mvars on the Generator Capability Curve and allow it to thermally stabilise. |  |  |
| 10 | With the Unit at Registered Capacity and the generator thermally stabilised, run for an additional 30 minutes and record all data. |  |  |
| 11 | With the Unit at Registered Capacity adjust the PF to unity. |  |  |
| 12 | Unit operator contacts NCC/CHCC and notifies them that the test is complete. |  |  |
| 13 | Unit operator follows NCC/CHCC instruction. |  | Instruction from NCC/CHCC \_\_\_\_\_\_ |
| 14 | 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> [↑](#footnote-ref-1)