Automatic Generator Control

[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 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 as required;
4. Mitigate issues arising during the test and report on system incidents.

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

NCC National Control Centre

AGC Automatic Generator Control

MEC Maximum Export Capacity

MVAr Mega Volt Ampere – reactive

MW Mega Watt

TSO Transmission System Operator

SDC Scheduling and Dispatch Code

OC Operating Code

DCS Distributed Control System

RTU Remote Terminal Unit

mA milliamp

ms milisecond

# 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 |
| Registered Capacity | UNIT to Specify |
| Contracted MEC | UNIT to Specify |
| Unit Fuel Type | Primary Fuel / Secondary Fuel, Gas / Distillate. |
| Installed Plant | Unit to Specify |
| AGC high limit (Registered Capacity) | Unit to Specify |
| AGC low limit (Minimum Load) | Unit to Specify |

# Grid Code References

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

**Glossary:**

|  |  |
| --- | --- |
| **Automatic Generator Control (AGC)** | A control system installed between the **NCC** and a **Power Station** whereby MW setpoints can be adjusted remotely by the **TSO** to reflect the **Dispatch Instruction** |
| **AGC Control Range**  | The range of loads over which **AGC** may be applied |
| **AGC Maximum Load** | The upper limit of the **AGC Control Range.** |
| **AGC Minimum Load**  | The lower limit of the **AGC Control Range.** |

1. The **TSO** may request **Generation Units** of **Registered Capacity** greater than or equal to 60MW to have the capacity to operate under **AGC** at all loads between
2. **AGC Minimum Load** and **AGC Maximum Load**

**OC.4.3.6 AUTOMATIC GENERATOR CONTORL (AGC)**

OC.4.3.6.1 The secondary **Frequency** regulation system operational on the **Transmission System** is known as the "**Automatic Generator Control**" (**AGC**).

OC.4.3.6.2 **Generation Units** and **Interconnectors** with a **Registered Capacity** of 60MW or greater are, under **Connection Conditions**, required to be connected to **AGC**, the **AGC Control Range** being a **Registered Operating Characteristic**.

OC.4.3.6.3 Other than as provided for in OC.4.3.6.4 and OC.4.3.6.5 all **Generation Units** and **Interconnectors** fitted with **AGC** shall operate under the control of **AGC** when within their **AGC Control Range**.

OC.4.3.6.4 In the event that the **Generator** or **Interconnector Operator** (acting in accordance with **Good Industry Practice**) considers that it is necessary to secure the reliability of a **Generation Unit** or **Interconnector**, or for the safety of personnel and/or **Plant**, to prevent a **Generation Unit** or **Interconnector** from operating under **AGC** and commences to control the MW output manually, then the **Generator** or **Interconnector Operator** shall inform the **TSO** of this without delay. **Generators** and **Interconnector Operators** shall also inform the **TSO** of the reasons for not operating the **Generating Unit** or **Interconnector** under **AGC**, and the course of action being taken to rectify the problem forthwith. When the problem has been rectified, the **Generator** or **Interconnector Operator** shall contact the **TSO** to arrange for the **Generation Unit** or **Interconnector** to return to operation under the control of **AGC**.

OC.4.3.6.5 The **TSO** may issue a **Dispatch Instruction** to a **Generator** or **Interconnector Operator** to prevent a **Generation Unit** or **Interconnector** (fitted with **AGC**) from operating under **AGC**, in accordance with **SDC2**.

OC.4.3.6.6 **Generation Units** or **Interconnectors** not operating under **AGC** for reasons set out in OC.4.3.6.4 and OC.4.3.6.5 shall nevertheless continue to follow **MW Dispatch Instructions** as required by SDC2.

1. **site Safety requirements**

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

|  |  |
| --- | --- |
| Personnel Protection Gear 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 description and pre conditions

## Purpose of the Test

The purpose of this test is to demonstrate requirement for Automatic Generator Control through operation of the system from NCC to the Unit.

## 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 can enable and disable the AGC scheme and set the AGC upper and lower limits; indications correctly received by NCC. The Unit shall respond when AGC has been activated by the Unit Operator and an AGC setpoint has been sent by NCC followed by an enable pulse.
2. The Unit responds correctly to instructions from NCC within the AGC Control Range.
3. NCC is able to issue MW dispatch setpoints directly into the Unit DCS with corresponding changes to the output of the Unit.
4. The AGC limits are applied correctly by the generator DCS.
5. AGC setpoints are entered into the NCC EMS in MW terms; they are then converted in the TSO RTU to a mA signal. This mA signal is issued to the Generator DCS. The DCS converts it back into a MW value. Test that the conversion process works well with negligible error in the conversion process (<0.5%).

## Instrumentation and Onsite Data Trending

All of the following trends 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 Point (MW)  | Unit to specify, 100ms or as agreed with TSO | Unit to specify |
| 2 | Reactive Power at Connection Point (Mvar) | Unit to specify, 100ms or as agreed with TSO | Unit to specify |
| 3 | Active Power at Generator (MW) | Unit to specify, 100ms or as agreed with TSO | Unit to specify |
| 4 | Reactive Power at Generator (Mvar) | Unit to specify, 100ms or as agreed with TSO | Unit to specify |
| 5 | AGC control on signal sent to NCC | Unit to specify, 100ms or as agreed with TSO | Unit to specify |
| 6 | AGC control off signal sent to NCC | Unit to specify, 100ms or as agreed with TSO | Unit to specify |
| 7 | AGC Indication - Upper Limit | Unit to specify, 100ms or as agreed with TSO | Unit to specify |
| 8 | AGC Indication - Lower Limit | Unit to specify, 100ms or as agreed with TSO | Unit to specify |
| 9 | AGC Setpoint Feedback | Unit to specify, 100ms or as agreed with TSO | Unit to specify |
| 10 | AGC Strobe/Enable Pulse  | Unit to specify, 100ms or as agreed with TSO | Unit to specify |
| 11 | AGC Analogue Output setpoint:  | Unit to specify, 100ms or as agreed with TSO | Unit to specify |

## Initial Conditions

Should “No” be answered to any of the following, contact NCC and agree next steps in advance of making any corrective actions.

|  |  |
| --- | --- |
| **Conditions** | **Check on day of test** |
| Test Profiles have been submitted and approved by neartime@eirgrid.com. |  |
| The setpoint command and signals have been signed off by emsservice@eirgrid.com end to end to/from the Unit DCS to/from NCC via the TSO RTU.  | Yes/No |
| Frequency response mode Off. This is carried out in agreement with NCC. | Yes / No |
| The Unit active power ramp rate is set at XX MW/min. This rate is fixed and is to remain in place for the duration of the test. | Yes / No |
| Unit is on load and stable in agreement with NCC. | Yes / No |
| Required signals, as described in section 7.3 are available | Yes / No |
| Unit to confirm that their control system inhibits the operator from entering Upper Limit lower than the Lower Limit or a Lower Limit higher than the Upper Limit. | Yes / No |

# Test Steps

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Step No.** | **Unit / NCC** | **Action** | **Time** | **Comment** |
| 1 | Unit | Unit Operator begins data recording for all trends noted in Section 7.3. |  |  |
| 2 | Unit | Unit Operator contacts NCC and requests permission to begin test and notes the following: 1. Generated MW.
2. Exported MW
3. AGC is disabled
 |  | Generated MW: \_\_\_\_ MWExported MW: \_\_\_\_ MWAGC position indication in NCC: \_\_\_\_ |
| 3 | NCC | NCC enters AGC setpoint of the current load setpoint of X MW. Setpoint feedback shall change to X MW with no change in load.  |  |  |
| 4 | Unit | The Unit Operator enables AGC operation and confirms the following with NCC:1. AGC position indication in NCC
2. Setpoint feedback received in NCC
3. No change in load
4. Generated MW
5. Exported MW
 |  | AGC position indication in NCC: On / OffFeedback in NCC: \_\_\_\_ MWChange in Load? Yes / NoGenerated MW: \_\_\_\_ MWExported MW: \_\_\_\_ MW |
| 5 | Unit | Unit Operator reduces AGC high limit from X MW to Y MW and confirms with NCC that the correct feedback has been received.  |  | Feedback in NCC: \_\_\_\_ MW |
| 6 | Unit | The Unit Operator increases the AGC low limit from X MW to ZMW and confirms with NCC that the correct feedback has been received.  |  | Feedback in NCC: \_\_\_\_ MW |
| 7 | Unit | The Unit Operator disables AGC operation and confirms the following with NCC.1. Feedback received in NCC.
2. No change in load.
 |  | AGC position indication in NCC: On / OffChange in Load? Yes / No |
| 8 | NCC | NCC enters AGC setpoint of X+5 MW, confirms that the setpoint feedback is X+5 MW and observes no change in load. |  |  |
| 9 | Unit | The Unit Operator notes the following:1. Feedback received in NCC.
2. No change in load.
3. Generated MW.
4. Exported MW.
 |  | Feedback in NCC: \_\_\_\_ MWChange in Load? Yes / NoGenerated MW: \_\_\_\_ MWExported MW: \_\_\_\_ MW |
| 10 | NCC | NCC enters AGC setpoint of X-5 MW, confirms that the setpoint feedback is X-5 MW and observes no change in load. |  |  |
| 11 | Unit | The Unit Operator notes the following:1. Feedback received in NCC.
2. No change in load.
3. Generated MW.
4. Exported MW.
 |  | Feedback in NCC: \_\_\_\_ MWChange in Load? Yes / NoGenerated MW: \_\_\_\_ MWExported MW: \_\_\_\_ MW |
| 12 | Unit | The Unit Operator enables AGC operation and confirm with NCC the following: 1. AGC enabled.
2. No change in Load.
 |  | AGC enabled: Yes / NoChange in Load? Yes / No. |
| 13 | NCC | NCC enters AGC setpoint of X+5 MW, confirms that the setpoint feedback is X+5 MW and observes a 5 MW increase in load. |  |  |
| 14 | Unit | When the unit stabilises the Unit Operator notes the following:1. Feedback received in NCC.
2. Confirms X+5 MW change in load.
3. Generated MW.
4. Exported MW.
 |  | Feedback in NCC: \_\_\_\_ MWChange in Load? Yes / NoGenerated MW: \_\_\_\_ MWExported MW: \_\_\_\_ MW |
| 15 | NCC | NCC enters AGC setpoint of X+25 MW, confirms that the setpoint feedback is X+25 MW and observes a 20 MW increase in load. |  |  |
| 16 | Unit | When the unit stabilises the Unit Operator notes the following:1. Feedback received in NCC.
2. Confirms X+25 MW change in load.
3. Generated MW.
4. Exported MW.
 |  | Feedback in NCC: \_\_\_\_ MWChange in Load? Yes / NoGenerated MW: \_\_\_\_ MWExported MW: \_\_\_\_ MW |
| 17 | NCC | NCC enters an AGC setpoint of X+60 MW, confirms that the setpoint feedback is X+ 60 MW. As this setpoint is greater than the upper AGC limit, NCC observes an increase in load to the upper setpoint limit.  |  |  |
| 18 | Unit | When the unit stabilises the Unit Operator notes the following:1. Feedback received in NCC.
2. Confirms change in load to upper AGC limit.
3. Generated MW.
4. Exported MW.
 |  | Feedback in NCC: \_\_\_\_ MWChange in Load? Yes / NoGenerated MW: \_\_\_\_ MWExported MW: \_\_\_\_ MW |
| 19 | NCC | NCC enters AGC setpoint to X MW (same setpoint as Step no. 3), confirms that the setpoint feedback is X MW and observes a decrease in load and records.  |  |  |
| 20 | Unit | When the unit stabilises the Unit Operator notes the following:1. Feedback received in NCC.
2. Confirms change in load to the upper AGC limit.
3. Generated MW.
4. Exported MW.
 |  | Feedback in NCC: \_\_\_\_ MWChange in Load? Yes / NoGenerated MW: \_\_\_\_ MWExported MW: \_\_\_\_ MW |
| 21 | NCC | NCC enters AGC setpoint of X-5 MW, confirms that the setpoint feedback is X-5 MW and observes a 5 MW decrease in load. |  |  |
| 22 | Unit | When the unit stabilises the Unit Operator notes the following:1. Feedback received in NCC.
2. Confirms X-5 MW change in load.
3. Generated MW.
4. Exported MW.
 |  | Feedback in NCC: \_\_\_\_ MWChange in Load? Yes / NoGenerated MW: \_\_\_\_ MWExported MW: \_\_\_\_ MW |
| 23 | NCC | NCC enters AGC setpoint of X-20 MW, confirms that the setpoint feedback is X-20 MW and observes a 15 MW decrease in load. |  |  |
| 24 | Unit | When the unit stabilises the Unit Operator notes the following:1. Feedback received in NCC.
2. Confirms 15 MW change in load.
3. Generated MW.
4. Exported MW.
 |  | Feedback in NCC: \_\_\_\_ MWChange in Load? Yes / NoGenerated MW: \_\_\_\_ MWExported MW: \_\_\_\_ MW |
| 25 | NCC | NCC enters an AGC setpoint of X-60 MW, confirms that the setpoint feedback is X-60 MW. As this setpoint is less than the lower AGC limit, NCC observes an decrease in load to the lower setpoint limit. |  |  |
| 26 | Unit | When the unit stabilises the Unit Operator notes the following:1. Feedback received in NCC.
2. Confirms change in load to the lower AGC limit.
3. Generated MW.
4. Exported MW.
 |  | Feedback in NCC: \_\_\_\_ MWChange in Load? Yes / NoGenerated MW: \_\_\_\_ MWExported MW: \_\_\_\_ MW |
| 27 | NCC | NCC enters AGC setpoint to X MW, confirms that the setpoint feedback is X MW (same setpoint as Step no. 3) and observes an increase in load).  |  |  |
| 28 |  | When the unit stabilises the Unit Operator notes the following:1. Feedback received in NCC.
2. Confirms change in load to the lower AGC limit.
3. Generated MW.
4. Exported MW.
 |  | Feedback in NCC: \_\_\_\_ MWChange in Load? Yes / NoGenerated MW: \_\_\_\_ MWExported MW: \_\_\_\_ MW |
| 29 | Unit | In agreement with NCC, the Unit Operator resets Upper and Lower AGC setpoint limits to X MW and X MW and confirms the following with NCC.1. Feedback received in NCC.
 |  | Feedback in NCC: \_\_\_\_ MW |
| 30 | Unit | In agreement with NCC, the Unit Operator disables AGC operation and confirm with NCC the following: 1. AGC disabled.
2. No change in Load.
 |  | AGC position indication in NCC: On / OffChange in Load? Yes / No |
| 31 | Unit | In agreement with NCC, the Unit Operator turns frequency response mode On.  |  | Frequency Response: On / Off |
| 32 | Unit | Unit Operator ends data recording for all trends noted in Section 7.3. |  |  |
| 33 | Unit | The Unit Operator informs NCC 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 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)