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STANDARD FOR GENERATORS**

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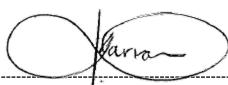


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Content

| | Page |
|---|------|
| 1. Introduction | 3 |
| 2. Supporting clauses | 3 |
| 2.1 Scope | 3 |
| 2.1.1 Purpose | 3 |
| 2.1.2 Applicability | 3 |
| 2.2 Normative/informative references | 4 |
| 2.2.1 Normative | 4 |
| 2.2.2 Informative | 4 |
| 2.3 Definitions | 4 |
| 2.3.1 General | 4 |
| 2.3.2 Disclosure classification | 4 |
| 2.4 Abbreviations | 5 |
| 2.5 Roles and responsibilities | 5 |
| 2.6 Process for monitoring | 5 |
| 2.7 Related/supporting documents | 5 |
| 3. Generator SCADA Commissioning | 6 |
| 3.1 Commissioning Roles and Responsibilities | 6 |
| 3.1.1 Generator Commissioning Manager | 6 |
| 3.1.2 Eskom Representative | 6 |
| 3.1.3 Eskom Representative's Role during Commissioning | 7 |
| 3.1.4 Eskom Control Centre Representative/s | 7 |
| 3.2 Pre-commissioning | 7 |
| 3.2.1 Prerequisites | 8 |
| 3.2.2 Smallworld Geographical Data Capture (GDC) for Distribution Master Stations | 8 |
| 3.2.3 Pre-commissioning: | 8 |
| 3.3 Establishment of the Gateway Communications with the Eskom Control Centres | 8 |
| 3.4 Energisation Phase | 9 |
| 3.4.1 Commissioning Prerequisites | 9 |
| 3.4.2 Point Types | 10 |
| 3.4.3 Point Commissioning Methodology to the Eskom Control Centres | 10 |
| 3.5 Pre Commercial Operation Date (COD) (Synchronisation phase) | 13 |
| 3.5.1 Cold Commissioning | 13 |
| 3.5.2 Hot Commissioning (Functional Testing) | 14 |
| 3.5.3 Sign off | 14 |
| 3.6 Defect Capturing and Clearance | 14 |
| 3.7 Post COD Signing Off | 15 |
| 3.7.1 SCADA related change control | 15 |
| 4. Authorization | 15 |
| 5. Revisions | 16 |
| 6. Development team | 16 |
| 7. Acknowledgements | 16 |

1. Introduction

SCADA commissioning to the Eskom Control Centre/s (ECC) involves the testing of signals between the Eskom Master Stations and Generator/s to ensure that all signals are configured correctly and operate as intended and agreed upon between Eskom and the Generator.

This commissioning standard is intended to provide both Eskom and the Generator commissioning teams with guidance on the procedure of commissioning of SCADA related data to ensure the safe and reliable operation and provision of transmission and distribution services.

This standard stipulates the minimum requirements for SCADA commissioning of Generator/s to Eskom's Transmission and Distribution Control Centres.

2. Supporting clauses

2.1 Scope

Documented in this standard are the requirements for the safe commissioning of SCADA related data signals between the Generator gateway and ECC/s including the point commissioning of Digital Inputs, Analogue Inputs, Digital Outputs, and Analogue Outputs.

The Scope of this standard includes:

- a) Roles and responsibilities of the SCADA Commissioning Team.
- b) The required deliverables for the SCADA Commissioning Team.
- c) The required level of Telecontrol testing to be performed during commissioning.
- d) SCADA commissioning document control post commissioning.

2.1.1 Purpose

The purpose of this document is to standardise the SCADA commissioning requirements and procedures for signal testing between Generators and Eskom and to ensure that the:

- a) Compliance to South Africa Grid code requirements for SCADA is adhered to.
- b) SCADA commissioning procedure and methodology is understood by the Generator and Eskom personnel.
- c) Commissioning of SCADA meets the requirements as stipulated in the Standard of Interconnection of Embedded Generation [3] and the agreed operation of the Generator plant.

2.1.2 Applicability

This standard applies to SCADA systems where the generating plant may be paralleled with the Eskom Transmission or Distribution network either permanently, periodically or temporarily.

This document shall apply to Eskom Holdings SOC Ltd and Independent Power Producers. This includes but not limited to:

- a) Contractors undertaking Substation Control System work on behalf of Eskom Generation, Transmission and Distribution divisions.
- b) Other Eskom subsidiaries that undertake Substation Control System work relating to the Transmission and Distribution interface.
- c) Generators

2.2 Normative/informative references

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

2.2.1 Normative

- [1] ISO 9001, Quality Management Systems.
- [2] Grid Connection Code for Renewable Power Plants (RPPs) connected to the Electricity Transmission System (TS) or Distribution System (DS) in South Africa V2.8, July 2014
- [3] 240-61268576: Standard of Interconnection of Embedded Generation, Section 4: Supervisory Control and Data Acquisition.
- [4] South African Grid Code V9, July 2014

2.2.2 Informative

- [5] Distribution Information Exchange Code V9

2.3 Definitions

2.3.1 General

| Definition | Description |
|--|--|
| Commissioning team | All persons involved in the commissioning process which includes the field and remote master station commissioning personnel |
| Eskom Control Centre | Eskom Control Centre refers to National Control Centre, STABNAC (Standby National Control Centre) and Regional Control Centres |
| Eskom Control Centre Representative | Refers to Eskom Control Centre representatives responsible for all SCADA related communication between Eskom Control Centre and the Generator for the purpose of commissioning. |
| Eskom Representative | Refers to the Eskom Grid/OUs personnel assigned to witness the commissioning of the Generator plant |
| Generator | A legal entity that operates or desires to operate any generating plant that is or will be connected to the Grid at MV or HV levels and renewable power plant or coal power plant connected at EHV levels. This definition includes all types of connected generation, including co-generators, renewables and coal. |
| PTM&C | The department within Eskom responsible to provide a technically sound platform for maintaining and operating the asset in line with the design output requirements as one of its responsibilities. |
| Supervisory switch | A panel or software switch that prevents supervisory control from operating the plant. |

2.3.2 Disclosure classification

Controlled disclosure: controlled disclosure to external parties (either enforced by law, or discretionary).

2.4 Abbreviations

| Abbreviation | Description |
|---------------------|--|
| AGC | Automatic Generation Control |
| COD | Commercial Operation Date |
| DMS | Distribution Management System |
| ECC | Eskom Control Centre |
| EHV | Extra High Voltage |
| EMS | Energy Management System |
| FAT | Factory Acceptance Test |
| GDC | Geographical Data Capture |
| HV | High Voltage |
| ID | Identity Document |
| MV | Medium Voltage |
| NCSS | National Control Systems Support |
| OU | Operating Unit |
| PPE | Personal Protective Equipment |
| PUC | Point of Utility Connection |
| RTU | Remote Terminal Unit |
| SAGC | South African Grid Code |
| SCADA | Supervisory Control and Data Acquisition |
| SCOT | Steering Committee of Technology |
| SLD | Station Line Diagram |

2.5 Roles and responsibilities

The implementation of this standard is the responsibility of Eskom Transmission and Distribution Control Centres, Generators and Eskom commissioning teams.

The accuracy of this standard shall be maintained by PTM&C Centre of Excellence, the Eskom Transmission Division Grids and the Distribution Operating Units.

Generator project managers, engineers, technicians, Eskom Control Centres, SCADA managers, National Control Systems Support (NCSS) personnel and Eskom Grid Commissioning teams are responsible for the application of this standard.

2.6 Process for monitoring

The process of monitoring of this standard shall be aligned to the process of monitoring of the Standard of Interconnection of Embedded Generation and the South African Grid Code. This standard shall align to the Grid Code Access Unit policies and requirements.

2.7 Related/supporting documents

Not applicable.

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3. Generator SCADA Commissioning

Documented in the proceeding sections is the cold and hot commissioning requirements and procedure for the different stages of SCADA commissioning of the Generator.

3.1 Commissioning Roles and Responsibilities

Section 3.1.1 to 3.1.3 defines the roles and responsibilities of the relevant personnel that would be involved in the commissioning of SCADA to Eskom Control Centre/s.

3.1.1 Generator Commissioning Manager

The Generator Commissioning Manager shall perform the following roles and responsibilities:

- a) Plan the commissioning activities and communicate these activities to Eskom Control Centres.
- b) Assign a Field Coordinator who is delegated the responsibility for installation, testing and commissioning of the Generator SCADA gateway. The contact details of the Field Coordinator must be made available to the Eskom representative/s.
- c) Notify the Eskom representative of the intention to conduct commissioning at least four weeks prior to commissioning date.
- d) Indicate to the Eskom representative the intended start date and end date of commissioning.
- e) Provide the Eskom representative with the safety clearance assurance that it is safe to work in the control room /on site.
- f) Ensure that the area that is not safe to work in, is barricaded.
- g) Ensure the Site Tagging system (System under Test, Danger; System in Operation) and / or permit to work is implemented to ensure that safe work practices are evident and maintained.
- h) Familiarise the Eskom representative with the setup (SCADA interface equipment and systems) prior to commencement of work.
- i) Introduce the Eskom representative to the safety requirements and the precautionary measures to be observed while on site.
- j) Advise the Eskom representatives who will be on site of all PPE requirements and documentation (e.g. ID) prior to commissioning date.
- k) Advise the Eskom representative of the Generator commissioning team details prior to commissioning date (e.g. Name of commissioning persons, contact details and role in the commissioning).
- l) The Generator shall make provision for comment and signature on the test sheet for acceptance of the results. The acceptance shall be signed by both Eskom representative and the Generator commissioning personnel.

3.1.2 Eskom Representative

The Eskom Representative shall perform the following roles and responsibilities:

- a) Participate in the meetings for SCADA related activities where necessary.
- b) Ensure involvement with the Contractor during the SCADA system communication setup and establishment with the Eskom's Master stations.
- c) Comply with any operating activity on plant during commissioning period.
- d) Notify the Generator in writing of any defect found during commissioning.
- e) Obtain the defect correction date from the Generator and arrange for verification date for re-testing of such defect/s.

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- f) Accept commissioning as successful once all the defects have been corrected.
- g) Advise the Generator of the Eskom representative/s witnessing the commissioning and the Eskom Control Center commissioning personnel prior to commissioning date (e.g. Name of commissioning persons, contact details and role in the commissioning)

3.1.3 Eskom Representative's Role during Commissioning

- a) The Eskom Representative is not expected to conduct commissioning of the Generator plant or do any operation on behalf of the Generator representative.
- b) The Eskom representative's role is only to witness and verify with the Eskom Control Centre/s that commissioning was conducted in accordance with this standard and each test result is a true reflection of the test.
- c) The Eskom representative must be familiar with the functionality under test and the expected result of each test.
- d) The Eskom representative reserves the right to query or request a repeat of any test should there be any discrepancy or disagreement with the outcome of any test step.
- e) The Eskom representative may contact the ECC representative for clarification on any signal under test.
- f) The Eskom representative must have a copy of the database signal list; and shall verify and make appropriate comment for each test outcome in the allocated space in the test procedure.
- g) The Eskom representative shall counter sign the test results along with the Generator commissioning personnel to confirm a true reflection of the results only.

3.1.4 Eskom Control Centre Representative/s

The Eskom Control Centre/s representative/s shall perform the following roles and responsibilities:

- a) Be the point of entry to Eskom for matters relating to the SCADA commissioning.
- b) Review the database for correctness and alignment with the Eskom naming convention.
- c) Provide signal details such as RTU signal addresses, type of signal (analogue, indication, control or alarm) and engineering values to the Generator. Verify details of alarm signals such as normal state and abnormal state of status signals.
- d) Update the database on the Master Station EMS/DMS system.
- e) Liaise between the Generator and the Eskom representative for project activity and the required involvement or required witnessing at different project stages.
- f) Provide inputs or comments to the test procedure as drafted by the Generator or its contractor.
- g) Allocate SCADA gateway addresses to the Generator.
- h) Specify the communication baud rate and communication protocol that shall be used.
- i) Ensure compliance with the South African Grid Code (SAGC) for Embedded Generation connection.
- j) Make provision for SCADA gateway communication infrastructure and frequency allocation if an UHF radio link is used.
- k) Conduct end-to-end commissioning between the Master Station and the Generator.

3.2 Pre-commissioning

Pre-commissioning is the process of performing non-functional testing of the plant to confirm the integrity of intended design of the system. It is during the pre-commissioning phase that all problems are resolved and systems confirmed to be functioning as expected. This shall be conducted prior to commissioning of the plant to the Eskom Control Centre.

3.2.1 Prerequisites

- a) The gateway protocol implementation factory acceptance test (FAT) is complete and approved by Eskom.
- b) The Generator has the latest database as agreed upon with the ECC Representative.
- c) The database revision number must be noted and be recorded on the pre-commissioning test sheet.
- d) All scaling and modes of operation have been confirmed and agreed upon.
- e) The Generator shall ensure pre-commissioning is complete before proceeding with commissioning to the ECC stage.
- f) Pre-commissioning shall be in line with the commissioning procedure as stipulated in this standard.
- g) The Commissioning procedure as drafted by Generator or its contractor is accepted by all parties. A final accepted version shall be distributed to all parties at least two working days prior to commissioning.

3.2.2 Smallworld Geographical Data Capture (GDC) for Distribution Master Stations

The Distribution Master Station modelling process and subsequent activities are dependent on the availability of Smallworld data. The SCADA Master Administrator requires the Smallworld Station Line Diagram (SLD) and GDC data to create an association between the GDC data and the RTU database. The SLD contains information (textual naming, plant attributes including electrical topology) relating to the equipment created in Smallworld (Lines, Capacitors, Breakers, Isolators etc...).

The Generator shall provide Land Development and the Distribution SCADA Master Administrator with the SLD and GDC at least six (6) weeks before the intended commissioning date.

3.2.3 Pre-commissioning:

- a) All signals must be tested from the furthest possible point during the pre-commissioning stage. This is to ensure that all signal types are working as per operation expectation.
- b) Upon completion of pre-commissioning of the plant signals, a pre-commissioning check sheet shall be signed by the Generator personnel who is accountable, and sent to the ECC representative/s as confirmation of the completion of this activity.
- c) Comments shall be written on the pre-commissioning check sheet and any reservations shall be indicated on the test sheet results.
- d) Soft database testing of all signals on the signal list may be performed as part of pre-commissioning. Soft database testing refers to simulation of signals from the RTU to the Master Station for mapping confirmation and scaling of analogues verification. However this may only be performed once communication between the Generator SCADA gateway and the ECC has been established.
- e) There shall be no requirement for the Eskom representative to witness the pre-commissioning test.
- f) The Generator SCADA gateway communication with the Eskom Control Centres is not required during this phase.

3.3 Establishment of the Gateway Communications with the Eskom Control Centres

The relevant Eskom Grid/OU shall ensure:

- a) The communication interface media is installed and tested as agreed upon (in conformance with the Standard of Interconnection of Embedded Generation [3]), communications option between the Generator and Eskom where applicable.
- b) The SCADA gateway communication hardware is available and installed to facilitate the required communication with the Eskom Control Centres applicable.

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- c) The required numbers of communication ports are available on the communication equipment where applicable.
- d) The Generator is updated with regards to the communication establishment challenges if any. SCADA managers must arrange alternative communication interface in case of a delay in the preferred communication option.

The Generator shall ensure the following:

- a) The communication interface media is installed and tested as agreed upon communication option between the Generator and Eskom.
- b) The SCADA gateway communication hardware is available and installed to facilitate the required communication with the ECC.
- c) The SCADA communication addresses are obtained from the ECC representative/s.
- d) The required number of communication ports are available and configured on the gateway.
- e) The applicable protocols are configured on the appropriate port depending on the Eskom Master Station.
- f) Communications must be established at least five working days prior to commissioning date.

3.4 Energisation Phase

The energisation commissioning phase pertains only to the interconnection of the power line between the Eskom substation bus bar and the Generator plant. No power is generated from the Generator plant at this stage and Eskom supplies the Generator with power. The purpose of this stage is to make power available to the Generator to facilitate the execution of other activities in the Generator plant.

The following must be verified before energisation commissioning commences:

- a) The latest and agreed upon database between ECC and Generator has been configured on the gateway.
- b) The ECC representative/s has the latest database loaded on the Master Station EMS/DMS.
- c) Ensure prior arrangement is made with the Master Station commissioning personnel for the work to be undertaken.
- d) Signals that cannot be simulated from the originating point may be simulated from the gateway or any simulator with the capability to do so. The signal must, however, have been proven to operate from the furthest point during the pre-commissioning stage. Such signal must be identified be stated prior to commissioning.
- e) The pre-commissioning signal list is available and populated with the agreed upon signals between ECC and Generator. This is necessary as a reference should there be any query relating to any signal that was confirmed to be working during the pre-commissioning phase.
- f) Eskom representative shall check that all signals listed in the pre-commissioning signal list have been tested.
- g) Any other documentation specified by the SAGC not stated in this document must also be adhered to and be available.

3.4.1 Commissioning Prerequisites

The following shall be implemented by the Generator prior to commissioning:

- a) Ensure that pre-commissioning is complete and all the requirements stipulated above are adhered to before commissioning commences.
- b) All supervisory isolating switches shall be in the Off position to isolate the primary plant from the secondary plant during commissioning. Permissions to operate the plant device shall be obtained from the ECC to mitigate any risk to the plant.

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- c) All commissioning personnel must be aware of and informed about the commissioning that will be undertaken at least a week before commissioning to ensure availability of all commissioning personnel on commissioning date.
 - d) Ensure that the latest revision of the signal list (database), and Station Line diagram (SLD) is available on site and available to the commissioning team at least six (6) weeks prior to commissioning date.
 - e) Confirm all prior requirements and documentation are completed in accordance with this standard requirement and that all equipment has been tested and is ready for initial energisation.
 - f) Ensure the communication channel to ECC is tested prior to the commissioning date and ensure that the phone at the control room at the Generator station is enabled with speaker phone functionality.
 - g) The Generator personnel who will be conducting the commissioning to ECC shall be agreed upon and communicated to the commissioning team prior to commissioning date.
 - h) A copy of the authorised pre-commissioning results must be made available to the commissioning team.

3.4.2 Point Types

Point types below may not be applicable to all types of Generator plants. The signal types available for commissioning will include the following:

- a) Digital Inputs: refers to the indications/alarms/status
- b) Digital Outputs: refers to the control commands for digital inputs
- c) Analogue Inputs: analogue values
- d) Analogue Outputs: analogue controls
- e) 32 bit AGC Bit string command

3.4.3 Point Commissioning Methodology to the Eskom Control Centres

The Eskom representative shall witness the functional testing between the Generator gateway and Master Stations. All signals shall be tested from the furthest originating point. If a signal cannot be tested at this stage from the furthest originating point, the verification of the signal functionality shall be confirmed during pre-commissioning by verifying the pre-commissioning test results.

3.4.3.1 Digital Inputs

The following steps shall be carried out during commissioning of the Digital input signals:

All digital input signals shall be time stamped at the IED level. The time offset shall be UTC to accommodate suppliers monitoring their plant from a different time zone.

- a) Single Bit: Without feedback
 - 1) The Generator commissioning personnel shall verify the present status of the signal with the ECC representative/s.
 - 2) The Generator personnel shall simulate the signal to the opposite state.
 - 3) The Generator personnel shall verify with the ECC representative/s that the digital input has changed state.
 - 4) At the end of each test, the Generator shall confirm with the ECC representative/s that the signal tested has reverted to its original state.
- b) Double Bits Without feedback
 - 1) The Generator shall confirm the present state of the signal with the ECC representative/s.
 - 2) The Generator shall test all four states (i.e. 00, 01, 10, 11).

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- 3) The Generator shall verify and confirm the state of each test with the ECC representative/s.
- 4) At the end of each test, the Generator shall confirm with the ECC representative/s that the signal tested has reverted to its original state.
- 5) The Eskom representative shall verify the test result with the Generator.

3.4.3.2 Digital Outputs

Commissioning of the Digital Output signals shall be completed in two stages, the first stage will be carried out with the protection or control panel/system supervisory switch in the "OFF" position. The intention of this is to verify that the correct point is activated without operating the plant device. The second stage shall be conducted with the protection or control panel/system supervisory switch in the "ON" position.

The following steps are applicable to single and double bit digital outputs:

- a) Testing without feedback
 - 1) The Generator shall ensure all supervisory switches are in the "OFF" position.
 - 2) The Generator shall confirm the supervisory state with the ECC representative/s operator.
 - 3) The ECC representative/s shall indicate to the Generator which primary plant signal will be issued.
 - 4) The ECC representative/s shall issue the control
 - Double bit: OFF/OPEN or ON/CLOSE.
 - Single bit – Toggle state.
 - 5) The Generator shall verify that the control is received on the Generator SCADA or monitoring device. .
 - 6) The Generator shall confirm that the plant did not operate.
 - 7) The Eskom representative shall verify the test result with the Generator.
- b) Testing with feedback
 - 1) The ECC representative/s shall confirm the specific primary plant "Remote/Local" indication is on "Remote" with the Generator.
 - 2) The Generator shall confirm the specific primary plant "Remote/Local" indication is on "Remote" with the ECC representative/s.
 - 3) The Generator shall ensure the supervisory switch for the bay under test is in the "ON" position.
 - 4) The Generator shall confirm the supervisory state with the ECC representative/s.
 - 5) The ECC representative/s shall indicate to the Generator which primary plant device will be operated.
 - 6) The ECC representative/s shall issue the supervisory command to operate the device under test (i.e. OFF/OPEN or ON/CLOSE).
 - 7) The Generator shall confirm receipt of the control.
 - 8) The Generator shall confirm that the plant did operate.
 - 9) The ECC representative/s shall indicate the status of the primary plant feedback with the Generator.
 - 10) The Generator shall confirm the status of the primary plant feedback with the ECC representative/s.
 - 11) The Eskom representative shall verify the test result with the Generator.

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- 12) The Generator commissioning personnel shall ensure that the supervisory switch of the bay under test is switched back to the "OFF" position upon completion of testing.

3.4.3.3 Analogue Inputs

- 1) The ECC representative/s shall indicate to the Generator which analogue input shall be tested.
- 2) The Generator personnel shall simulate the point to the specified analogue input at a minimum of three values.
- 3) The ECC representative/s shall confirm with the Generator personnel, the analogue value received.
- 4) The Generator shall acknowledge the analogue input value confirmation from ECC representative/s.
- 5) The Eskom representative shall verify the test result with the Generator.

3.4.3.4 Analogue Outputs

- a) Testing without feedback
 - 1) The Generator shall ensure all supervisory switches are in the "OFF" position.
 - 2) The ECC representative/s shall indicate to the Generator which analogue output will be tested.
 - 3) The Generator shall confirm the analogue output that shall be tested with the ECC representative/s.
 - 4) The ECC representative/s operator shall indicate the present real analogue value with the Generator.
 - 5) The Generator shall confirm the present real analogue value with the ECC representative/s.
 - 6) The ECC representative/s shall indicate the value of the analogue output that shall be sent.
 - 7) The Generator shall confirm the value of the analogue output that shall be received.
 - 8) The ECC representative/s shall issue the analogue output.
 - 9) The Generator shall confirm the real analogue value received on the HMI or workstation with the ECC representative/s.
 - 10) The Generator shall confirm that the plant did not operate.
 - 11) The Eskom representative shall verify the test result with the Generator.
- b) Testing with feedback
 - 1) The ECC representative/s shall confirm the specific primary plant "Remote/Local" indication is on "Remote" with the Generator.
 - 2) The Generator shall confirm the specific primary plant "Remote/Local" indication is on "Remote" with the ECC representative/s.
 - 3) The Generator shall ensure the supervisory switch for the bay under test is in the "ON" position.
 - 4) The Generator shall confirm the supervisory state with the ECC representative/s operator.
 - 5) The ECC representative/s shall indicate to the Generator which primary plant device will be operated.
 - 6) The Generator shall confirm the analogue output that shall be tested with the ECC representative/s.
 - 7) The ECC representative/s shall indicate the present real analogue value with the Generator.
 - 8) The Generator shall confirm the present real analogue value with the ECC representative/s.
 - 9) The ECC representative/s shall indicate the value of the analogue output that shall be sent.

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- 10) The Generator shall confirm the value of the analogue output that shall be received.
- 11) The ECC representative/s shall issue the analogue output command.
- 12) The Generator shall confirm the real analogue value received on the HMI or workstation with the ECC representative/s.
- 13) The ECC representative/s shall indicate the real analogue value of the primary plant feedback with the Generator.
- 14) The Generator shall confirm the real analogue value of the primary plant feedback with the ECC representative/s.
- 15) The Eskom representative shall verify the test result with the Generator.
- 16) The Generator shall ensure that the supervisory switch of the bay under test is switched back to the "OFF" position upon completion of testing.

3.4.3.5 Sign off

- a) The Field Coordinator shall confirm that equipment has been commissioned and is ready for energisation.
- b) The Eskom Representative is required to sign-off that the gateway has been tested and is ready for initial energisation.

3.5 Pre Commercial Operation Date (COD) (Synchronisation phase)

3.5.1 Cold Commissioning

Cold commissioning refers to the pre-commissioning of the generation plant through the Generator gateway. This is an end-to-end test between the Generator and the ECC. The Eskom representative shall witness this phase of commissioning on site. The purpose of cold commissioning is to address any possible problems before functional test (Hot commissioning) commences.

The Point of Utility Connection (PUC) shall be disconnected during Cold Commissioning.

- a) The Generator shall ensure that all interconnecting feeder protection panels' supervisory switches are in the "OFF" position. The Generator shall confirm with the ECC representative/s and the ECC representative/s shall acknowledge the status of the switches.
- b) The purpose of this is to mitigate any inadvertent operation of the feeder circuit breaker during the test.
- c) All test results of Cold Commissioning shall be recorded in the commissioning signal list. The cold pre-commissioning signal list shall be in the same format as the Hot Commissioning signal list.
- d) The Eskom representative will be required to witness Cold Commissioning.
- e) The Cold Commissioning test results shall be sent to the ECC representative/s for reference.

3.5.1.1 Prerequisites:

- a) Notify the ECC representative/s of the intended Cold Commissioning at least five working days prior to commissioning date.
- b) Ensure that the Generator gateway is functional and online prior to commencement of the work.
- c) The latest and agreed upon database between ECC representative/s and Generator has been configured on the gateway.
- d) The ECC representative/s has the latest database loaded on the Master Station EMS/DMS.
- e) The Eskom representative has been notified and has confirmed his/her availability to witness the cold commissioning test.

3.5.2 Hot Commissioning (Functional Testing)

Eskom shall witness the functional testing between the Generator gateway and Master Station end to end. This will be performed prior to commercial operation.

Hot commissioning refers to commissioning of the generation plant through the Generator gateway to the ECC. This is an end-to-end test and it involves both the Generator and the ECC personnel. The purpose of Hot Commissioning is to validate and confirm that the Generator plant responds in accordance with the design specification and compliance with the Grid Code requirements.

Successful Hot Commissioning conclusion will ensure plant readiness for synchronisation.

The following must be noted:

- a) The Generator shall ensure that all interconnecting feeder protection panels' supervisory switches are in the "OFF" position prior to commencement of the test. The Generator shall confirm with the ECC representative/s and the ECC representative/s shall acknowledge the status of the switches. The purpose of this is to mitigate any inadvertent operation of the feeder circuit breaker during the test.
- b) Eskom representative shall be required to witness this commissioning.

3.5.2.1 Prerequisites:

- a) Notify the ECC representative/s of the intended Hot Commissioning at least five working days prior to commissioning date.
- b) Ensure that the Generator gateway is functional and online prior to commencement of the work.
- c) The latest and agreed upon database between ECC representative/s and Generator has been configured on the gateway.
- d) The ECC representative/s has the latest database to be commissioned loaded on the Master Station EMS/DMS.
- e) The Eskom representative has been notified and has confirmed his/her availability to witness the hot commissioning test.
- f) Ensure that all members of the commissioning team have the latest revision of the functional test procedure as drafted by the Generator or its contractor and agreed by all parties

3.5.3 Sign off

- a) The Field Coordinator shall confirm with ECC that all functional requirements are met.
- b) The Generator Commissioning manager shall forward the test results of the functionality test to the ECC representative/s and Eskom project manager.

3.6 Defect Capturing and Clearance

- a) The Generator commissioning personnel shall generate and manage a defect list during the execution of the project.
- b) The Eskom representative shall verify each defect captured.
- c) Each defect shall have a reference number for tracking and reference purpose.
- d) The Generator field coordinator shall forward the defects notification to the Generator Commissioning Manager.
- e) The Generator Commissioning Manager shall forward the defects notification to the ECC representative/s.
- f) The Generator Commissioning Manager shall arrange with the relevant contractor to clear the defect identified.

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- g) The relevant Contractor will notify the Commissioning Manager once the defects have been cleared.
- h) The Commissioning Manager shall notify the ECC representative/s about the clearance of the defect/s and communicate test results to the ECC representative/s.
- i) The Commissioning Manager shall arrange for re-commissioning with the ECC representative/s.
- j) The ECC representative/s reserves the right to request re-testing of any other function previously tested to verify that nothing else was negatively affected during the correction of the defect.

3.7 Post COD Signing Off

There shall be no changes made after the COD to the database/configuration/power plant controller without prior notice given to the ECC representative/s.

3.7.1 SCADA related change control

- a) If the work is to be undertaken on a commissioned plant, the ECC representative/s must be notified at least one (1) day before commencement of the planned work.
- b) The detail of work to be performed shall be communicated to the ECC representative/s prior to commencement of work.
- c) All changes shall be reported back to ECC representative/s on completion.
- d) The Generator shall report back when the work is complete.

4. Authorization

This document has been seen and accepted by:

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| Craig Moran | Group IT Architecture |
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| George Daniel | Standards and Implementation Engineer - GOU |
| Gilbert Valentyn | Transmission Southern Grid Secondary Plant Manager |
| Hennie Nel | Portfolio Manager (Dx) |
| Ian Naicker | PTM&C – Control & Automation Technology & Support – Chief Engineer |
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5. Revisions

| Date | Rev | Compiler | Remarks |
|-------------|------------|---------------------------|--|
| April 2021 | 2 | J Ranyane | Made minor changes and corrections in the document |
| Jan 2016 | 1 | J. Ranyane M. Govender | First Issue |

6. Development team

The following people were involved in the development of this document:

- Michelle Govender
- James Ranyane

7. Acknowledgements

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- Rodney Jose
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