

	<b>Procedure</b>	<b>GX Peaking</b>
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## **1. INTRODUCTION**

This procedure defines the responsibilities and processes to be followed during the Sere Solar PV Project Commissioning. The project is an EPC (Engineering, Procurement and Construction) contract.

## **2. SCOPE**

The scope of this procedure is the commissioning process to be followed by the Sere Solar PV Project through all the phases of construction up to commissioning.

### **2.1 PURPOSE**

The purpose of this document is to ensure:

- [1] The requirements of the OHS Act and the Employer's Safety Standards are effectively implemented by the Employer's and the Contractor's personnel.
- [2] Meaningful communication links and interfaces is established between the Sere Solar PV Project staff, Contractor's staff, and Generation staff.
- [3] Contractual requirements are met in a timely and cost-effective manner.
- [4] Generation receives an asset of good quality.

#### **2.1.1 APPLICABILITY**

This procedure is applicable to all associated with the commissioning of the Sere Solar PV Project.

#### **2.1.2 EFFECTIVE DATE**

The effective date of this procedure is the date that the procedure is authorised.

## **2.2 NORMATIVE/INFORMATIVE REFERENCES**

### **2.2.1 NORMATIVE REFERENCES**

- [1] 240-114967625 – Operating Regulations for High Voltage Systems
- [2] 240-150642762 – Generation Plant Safety Regulations
- [3] Act No. 85 of 1993 – Occupational Health and Safety Act
- [4] The South African Grid Code
- [5] SANS 0142 Part 1 – Inspection and Test Plans of electrical equipment
- [6] 240-127618272 – Completion of Mega and Major Power Plant projects, Commissioning, Take-over from Contractors and Hand-over to the Generation Business.

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## 2.2.2 INFORMATIVE REFERENCES

N/A

## 2.3 DEFINITIONS

**Appointed Operator** – A person appointed as per the Operating Regulations for High Voltage Systems 240-114967625 & to do operating.

**Appointed Person** – A person authorised as per the 240-150642762 Generation Plant Safety Regulations & as per the 240-114967625 Operating Regulations for High Voltage Systems and responsible for ensuring that isolations and de-isolations on the Plant covered by a permit to work is effectively carried out in terms of the regulations.

**Authorised Person** – A person appointed as per the 240-114967625 Operating Regulations for High Voltage Systems.

**Certificate of Compliance** – A certificate issued by an accredited person certifying that the installation complies with the relevant specifications and standards (e.g. electrical installation or part of an electrical installation)

**Client** – The Generation Division is the Client, represented by the Client's Representative

**Client Representative** – A person appointed to represent Peaking Generation

**Cold Commissioning** – All testing prior to applying energy, excluding all Plant power supplies required for Cold Commissioning.

**Commercial Operation Date** – The date on which Grid Code Management declare the Unit commercially operational.

**Commissioning** – The process of putting into service an item of Plant, which has been successfully tested and safety cleared in accordance with the contractual and performance requirements.

**Commissioning lock** - A lock used to prevent unauthorised operating of safety cleared Plant during the commissioning period or when commissioning is temporarily suspended by locking out the energy source to the relevant Plant by the Commissioning Representative for that period.

**Commissioning Period** – The period from the date that the Safety Clearance Certificate is issued until Completion of commissioning.

**Commissioning Safety Lock** – A lock used to lock the boundary points between Safety Cleared systems and non-Safety Cleared systems and for which only a unique key is available.

**Commissioning Start-up Meeting Committee** – A representative body of persons who meet frequently to plan, schedule, co-ordinate and interface construction completion, Plant checks and commissioning activities that is chaired by the Eskom Project Manager or his representative.

**Commissioning Working Party (CWP)** – A body of persons who meet as appointed, to co-ordinate and implement appropriate commissioning activities required to establish the performance of machinery and equipment under its control. Also responsible for determining

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the adequacy of testing of Plant for initial energising and controls the issuing of the safety clearance certificate. The CWP can be assembled at any time when requested to by the Eskom Project manager or his representative to attend to problems that may arise requiring the dedicated attention of specialist persons. The commissioning working party must comprise of the following stakeholder's *Contractor, Employer engineering, Eskom Project Manager and Client's representative*

**Commissioning Working Party Chairman (CWPC)** – The person appointed in writing by the *Eskom Project Manager* to be responsible for the coordination of the commissioning of a defined item of Plant.

#### Definitions referred to in the ECC Contract;

- **Completion** – When all requirements and obligations for completion as detailed in each specific contract have been met - Refer Core Clause 11.2 (2)
- **Completion Date** – As defined in each specific contract - Refer Core Clause 11.2 (3)
- **Contract Date** – The date when each specific contract came into existence - Refer Core Clause 11.2 (4)
- **Contractor** – Refer C1.2 Contract Data Part two, Clause 10.1 Data provided by the *Contractor*
- **Defect Certificate** – The *Defect Certificate* signifies the end of most of obligations of the parties. Uncorrected defects listed in the Defects Certificate are dealt with using the procedure set out in clause 45 of the NEC explanatory notes - Refer Core Clause 11.2 (6)
- **defect correction period** – The time period as defined in the contract data of a specific contract, within which the Contractor makes good, notified Defects - Refer C1.2 Contract Data, Part one, Data provided by the *Employer* Clause 43.2
- **defects date** – The time period after completion of the whole of the works as defined in the contract data of a specific contract - Refer C1.2 Contract Data, Part one, Data provided by the *Employer* Clause 42.2
- **Employer** – Eskom Holdings Limited Reg. No. 2002/015527/06 - Refer C1.2 Contract Data, Part one, Data provided by the *Employer* Clause 10.1
- **Inspection** – Refer Core Clause 40 of the ECC
- **Project Manager** – The person appointed by the *Employer* to perform the duties of the *Project Manager* in terms of the NEC - Refer C1.2 Contract Data Part one, Data provided by the *Employer* Clause 10.1
- **Supervisor** – The person appointed by the *Employer* to perform the duties of the *Supervisor* in terms of the NEC - Refer C1.2 Contract Data Part one, Data provided by the *Employer* Clause 10.1.
- **Testing** – Refer Core Clause 40
- **Take Over** – Refer Core Clause 35.
- **The works** – Those activities defined in each contract for which the *Contractor* is to provide equipment and/or services - Refer C1.2 Contract Data Part on, Data provided by the *Employer* Clause 11.2 (13)

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**Documentation package** – The package that will be provided to the Client during the hand-over to be as per the agreed hand-over list and includes the following:

- Factory Acceptance Test Certificates where applicable.
- Safety Clearance Certificate.
- *Contractor* Plant System/Sub-System Commissioning Procedure.
- Hand Over Certificate (between Sere Solar PV project and the Client for a specific system/s).
- Final inspection reports (will be developed for each system from relevant scope of work).
- Operating, Training and Maintenance Manuals.
- KKS & labelling list.
- All applicable drawings.
- *Contractor* Quality Control Plans.
- *Contractor* Quality Inspection Plans.
- SRD requirements (per system/s) compared with actual.
- Spares list.
- No simulations (i.e., Protections bypassed for example) should be confirmed with commissioning certificate.
- Test and statutory certificates (e.g., internal arc proof/type test certificates for switchgear, Certificate of Compliance, etc.).
- Calibration certificates

**Energising** – The application of voltage to machinery by electrical connection from other energised power systems or putting into operation by mechanical means or charging of pipe work or ducts.

**Generation** – Eskom Generation Division.

**Installation Electrician** – A qualified Electrician accredited in terms of SANS 10142 Part 1 certifying that an electrical installation complies with the relevant specifications and standards.

**Isolated** – Make plant safe to work on by effectively disconnecting it from all possible sources of dangerous energy and/or harmful substances.

**Master Installation Electrician** – A qualified Electrician accredited in terms of SANS 10142 Part 1 certifying that an electrical installation inside a hazardous area complies with the relevant specifications and standards.

**Operating Lock** – A lock used by the Appointed Person/Appointed Operator to lock a Key Safe together with a Safety Lock for isolating purposes on Safety Cleared plant for which a permit to work is required.

**Permit to Work** – Means a written declaration on the permit to work form, signed by the Appointed Person and issued to the Responsible Person in charge of the work, informing the latter that the plant to be worked on has been isolated as detailed.

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**Plant Matrix** – A document outlining how the plant is broken down into Systems and Sub-Systems for the purpose of Safety Clearances and Commissioning.

**Plant Safety Regulations** – The regulations for the application of compulsory health and safety standards and procedures for the safeguard of plant and the protection of all persons who work on plant and machinery under the control of the *Employer*.

**Project Manager** – The person appointed with the prime responsibility for completing the project within the approved constraints of time, cost, scope and quality.

**Punch list** – The list of outstanding Defects

**Quality** – The degree to which a set of inherent characteristics of an object fulfils requirements.

**Quality Assurance** – part of quality management focused on providing confidence that quality requirements will be fulfilled.

**Quality Control** – part of quality management focused on fulfilling quality requirements.

**Contractor Quality Management System** – set of interrelated or interacting elements of an organization to establish policies and objectives, and processes to achieve those objectives.

**Contractor Quality Representative** – A person appointed with delegated responsibility and authority for control of the quality within the AT Project.

**Quality Surveillance** – The continuous evaluation of the status of procedures, methods, conditions, products, processes and services and analysis of records in relation to stated references to ensure that applicable requirements are met.

**Responsible Person** – A person who has been authorised in terms of the Generation Plant Safety Regulations and/or Operating Regulation for High Voltage Systems to be responsible for ensuring that the work on the plant covered by a permit to work can be carried out and executed taking health and safety precautions into account and within the terms of these regulations.

**Safety Lock** – A lock used for locking of isolations and for which only a single unique key is available.

**Safety Clearance Certificate** – A certificate issued by the *Employer* to the *Contractor* that is mutually agreed with the Client and *Contractor's* representative that from the time and date stated the specified plant or section of plant is under the *Employer's* control. Further access to plant is only permissible through the *Employer's* work permit system.

**Eskom Representative** – A person appointed by the *Eskom Project Manager* to execute certain tasks and responsibilities on his behalf.

## 2.4 ABBREVIATIONS

Abbreviations	Description
AIA	Approved Inspection Authority
CAR	Corrective Action Request
CO	Commercial Operation
COC	Certificate of Compliance
COD	Commercial Operation Date
CWP	Commissioning Working Party

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<b>Abbreviations</b>	<b>Description</b>
CWPC	Commissioning Working Party Chairman
ECC	Engineering and Construction Contract
FAT	Factory Acceptance Test
GCR	Grid Code Requirement
HOF	Hand-over file
IE	Installation Electrician
ITP	Inspection and Test Plan
KKS	Kraftwerk Kennzeichen System
MIE	Master Installation Electrician
NCR	Non Conformance Report
NDT	Non Destructive Testing
OEM	Original Equipment Manufacturer
OHS	Occupational Health and Safety Act number 85 of 1993, as amended
ORHVS	Eskom Operation Regulations for High Voltage Systems
PID	Process and Instrumentation Diagram
PCR	Pre-Commissioning Review
EPEM	Employer Project Engineering Manager
PSR	Plant Safety Regulations
PTW	Permit to Work
QCP	Quality Control Plan
SABS	South African Bureau of Standards
SANS	South African National Standards
SAT	Site Acceptance Test
SCC	Safety Clearance Certificate
SFT	Sanction for Test
SRD	Stakeholder Requirement Definition
URS	User Requirement Specification

## **2.5 ROLES AND RESPONSIBILITIES**

### **2.5.1 EMPLOYER PROJECT MANAGER**

The *Eskom Project Manager's* responsibilities are:

- [1] Ensuring that the requirements for construction completion, Plant checks, quality management, (Assurance and Control) commissioning, take-over and hand-over are included in the PMP and project schedule.
- [2] Establish communication / interface links and meet on a regular basis with the *Contractor, Employer engineering* and *Client's representatives* for the purpose of discussing progress and issues regarding:
  - Construction Completion
  - Plant Checks

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- Commissioning
  - Take-over
  - Safety Assurance
  - Quality Assurance
  - Any other relevant issues within his scope
- [3] Identify those working areas, buildings, plant and machinery, etc where construction completion inspection, safety clearance, and take-over certificate, defects certificate and final certificate as appropriate are to be issued.
- [4] Appoints *Commissioning Working Party Chairman*.
- [5] Develop in conjunction with the *Contractor, Employer Engineering Manager* and Client's *Representative* a Plant matrix that outlines how the Plant will be checked for completion, commissioned, and taken over and the requirements to affect it.
- [6] Ensure that the Plant is constructed and commissioned as per:
- Authorised PMP and project schedule,
  - Conditions of the contract,
  - Completed in a sequence to support the plant commissioning sequence.
- [7] Ensure that the construction checks and Plant checks are done by the *Contractor*, and *Employer engineering* after the QCP's have been signed-off and the *Contractor* have submitted the following:
- Application for Eskom's inspection of the Work / Part of the Works
  - Partial / Final inspection certificate
- [8] Ensure that Defects found during the commissioning and *Defects Correction Periods* are corrected.
- [9] Ensure that the Plant is taken-over from the contractor and handed-over to the Client with all the related documentation.
- [10] Ensure that the Plant is operated and maintained as per statutory requirements before hand-over. Taking the Eskom Plant Safety Regulations and Operating Regulations for High Voltage systems into account.
- [11] Accountable for Grid Code Compliance.
- [12] Hold Construction and Commissioning meetings including start-up meetings, plant inspection meetings and relevant commissioning meetings.
- [13] Develop a Plant matrix referencing the various start-up packages required to commission the Plant via a scoping method utilising P&ID's to ensure that no Plant is overlooked for commissioning, the approach will be systems based with Plant breakdown structure or an approved referencing system. (KKS)
- [14] Develop a start-up / commissioning schedule, update it on a regular basis and distribute it to the parties involved with commissioning activities and ensure it is integrated into the construction schedule.
- [15] Chair the start-up meeting.

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- [16] Coordinate start-up / commissioning activities between the *Contractors*, Employer Engineering Manager / engineer, and the Client Representative and ensure that interfaces between all parties are defined.
- [17] Facilitate the commissioning process with external parties (National Control, Distribution, Transmission, etc.)
- [18] Ensure that the required permits are issued to all personnel that require performing work (as per PSR and ORHVS) on the Plant after the safety clearance certificate has been issued.
- [19] Ensure that plant is operated by an Authorised Eskom operator or any person authorised by the appointed Eskom committee to do so.
- [20] Develop a hand-over schedule detailing the hand-over process between the Contractor and the Employer.
- [21] Ensure that Safety Clearance Certificates are completed, signed and distributed accordingly.

### **2.5.2 Employer Engineering Manager**

- [1] Ensure the review and approval of quality assurance and quality control plans (QCP's) and identify hold and witness points.
- [2] Ensure that construction checks, and Plant check sheets required for checking the Plant as per the approved Plant matrix are developed.
- [3] Ensure that quality control is done and that the QCP's are signed off after construction completion.
- [4] Ensure that the terminal points are interfaced smoothly between contractors / other suppliers.
- [5] Participate in construction completion checks and sign off construction checks, Plant checks and safety clearances, etc.
- [6] Facilitate the technical meetings and ensure that all Plant problems and issues relating to the technical integrity of the project are resolved e.g. scope changes, technical specifications, Design, quality, exceptions, Defects, configuration management, etc.
- [7] Attend the Start-up Meeting and participate in the CWP.
- [8] Review control and operating philosophies for content, clarity and adequacy.
- [9] Review and approve the appropriate routine maintenance requirements as issued in accordance with the *Contractor's* specifications.
- [10] Assist with plant commissioning and optimisation and verify that the Plant performs as per the requirements set out in the technical specifications, Plant designs and project URS / ERS.
- [11] Participate in the take-over of Plant as per Plant matrix.
- [12] Ensure that configuration management is finalised e.g., drawings, Plant codification, operating, maintenance, and training manuals, etc.
- [13] Ensure that Design changes resulting from change requests are approved by the relevant accountable engineering Design disciplines.

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### **2.5.3 CONTRACTOR**

The Contractor is responsible to:

- [1] The *Contractor* to perform his duties as stipulated in his contract which includes the requirements as stated in this Procedure. This includes the following commissioning requirements.
  - Ensure that a commissioning procedure is compiled for each Plant system / sub-system and plant item requiring commissioning.
  - Timeously submit the application for Eskom inspection as and when required to ensure that the Plant/systems are constructed, build and available as per the accepted schedules and programmes.
  - Comply to the Eskom Plant Safety Regulations and Operating Regulations for High Voltage Systems on safety cleared plant.
  - Commission Plant as required.
  - Provide documentation required for the commissioning and operation of the Plant as well as that specified in the contract. This include but is not limited to documentation on drawings, Plant codification, operating, maintenance, commissioning, training manuals as well as statutory required documents e.g., pressure tests, Megger tests, etc.
  - Clear Defects as required.
- [2] Take part in planning the commissioning activities with the employer in the start-up meeting.
- [3] Ensure that the following personal is available and authorised by the employers ORHVS/PSR authorisation committee well before safety clearances are issued on the plant:
  - Responsible person
- [4] Ensure that a commissioning procedure is compiled for each Plant system / sub-system and plant item requiring commissioning and distribute them to the Eskom Project Manager for acceptance and approval.
- [5] Ensure that appropriate operating instructions are issued to the employer in accordance with the *Contractor's* specifications when safety clearance certificates is received.
- [6] Ensure that appropriate routine maintenance requirements are issued.
- [7] Ensure that Plant performance tests are carried out in accordance with the documented plan with clearly set time periods and requirements.
- [8] Coordinate and ensure that the Plant is optimised after completion of all tests and unit synchronisation.
- [9] Ensure that the Plant performance complies with the acceptance criteria stipulated in the individual contracts and the URS / SRD.
- [10] Co-ordinate and submit documentation of control demonstrations and unit capabilities for Plant take-over.

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- [11] Ensure the control and operating philosophies are reviewed for content, clarity and adequacy by the required Employer disciplines.
- [12] Review with the employer that the Plant matrix referencing the various start-up packages required to commission the Plant via a scoping method utilising P&ID's to ensure that no Plant is overlooked for commissioning, the approach will be systems based with plant breakdown structure or an approved referencing system (e.g., KKS).
- [13] Confirm with the employer that commissioning interfaces between all parties are defined.
- [14] Ensure Plant safety regulations and ORHVS as defined by the Employer is followed.
- [15] Demonstrate to the Employer Project Manager that all optimisation criteria and capabilities have been met.
- [16] Confirm submission of documentation to demonstrate unit capabilities for Plant take-over and hand-over.
- [17] Facilitate the Grid Code compliance process with employer.
- [18] Obtain in conjunction with the Eskom Project Manager the Grid Code Compliance Certificate.
- [19] Ensures that the Client Representative, Employer Project Manager, OEM Manager and National Control have both signed off Grid Code Compliance to verify that all the conditions have been met for the Grid Code as per the South African Grid Code.

#### **2.5.4 COMMISSIONING WORKING PARTY CHAIR (CWPC)**

The CWPC is responsible to:

- [1] Ensure that the Commissioning Working Party (CWP) is appointed for each Plant system / sub-system and plant item as per the Plant matrix prerequisites for the commissioning programme have been satisfied and all the pre-operational tests/checks have been completed.
- [2] Compile, obtain agreement of the commissioning procedure for the defined Plant system / sub-system and plant item, recommend and obtain approval (ensure compliance to the URS / SRD, Plant Design, and operating / control philosophy when compiling the commissioning procedure).
- [3] Ensure that anticipated activities, within a six-week rolling period, are recorded in the start-up meeting minutes.
- [4] Verify that the installation of structures, systems and components has been satisfactorily completed and codified for proper identification.
- [5] Maintain and distribute all process documentation.
- [6] Be involved in and responsible for:
  - Partial / final inspections.
  - Commissioning documentation requirements.
  - Plant Safety Clearance inspections.

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- Commissioning of plant.
- Notification of defects.

#### **2.5.5 COMMISSIONING WORKING PARTY (CWP)**

The CWP is responsible to:

- [1] Ensure compliance with the SRD, plant designs and operating/control philosophies when recommending Plant System/Sub-System Commissioning Procedures.
- [2] Be involved in:
  - Partial/Final Inspections.
  - Commissioning documentation requirements.
  - Commissioning of Plant.
  - Plant Safety Clearance Inspections.
  - Notification of defects process.

#### **2.5.6 Client Representative**

In addition to the safety requirements identified under the responsibility in terms of safety requirements, the Client Representative (Generation Representative) ensures that the following responsibilities are complied with:

- [1] Participate in meetings, activities, and decision-making processes, e.g., construction completion inspections, safety clearances, commissioning, take-over, provisional and final hand-over of the Plant.
- [2] Ensure involvement of Client personnel during construction checks and final inspection of Plant systems and plant items before Safety Clearance Certificates are issued.
- [3] Comply with commissioning instructions, provided it is safe, when carrying out any operating activities on Plant and machinery during the commissioning period.
- [4] Ensure that routine maintenance is carried out in accordance with the Contractor's recommendations after taking over of Plant.
- [5] Notify the Employer Project Manager /Employer Representative of any Defects found on Plant and machinery from the commencement of the commissioning period to the defects date. Further to allow reasonable access to Plant and machinery for Contractor(s) to rectify Defects after hand-over (Use Defect Notification Form).
- [6] Accept the *Works* with reasonable defects as agreed per the plant matrix from the Employer Project Manager and Contractor after verification that it is acceptable for use. Reasonable defects are those defects that are categorised as not having an impact on the safety or the safe operation of the Plant and does not affect the Plant or operation there-off in any major manner.
- [7] Confirm adherence to the Grid Code compliance processes.
- [8] Confirm the operating and maintenance manuals are reviewed for content, clarity and adequacy.

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- [9] Provide status reports covering the performance of the Plant up to the *Defects Date* to the Employer Project Manager to take action where necessary.
- [10] Ensure that all hand-over documentation packages received on the project is properly indexed and filed for future use by the plant.
- [11] Ensure that arrangements are made to allow access for the *Contractor* to do the plant performance tests if done after hand-over.

## **2.6 PROCESS FOR MONITORING**

- [1] This procedure is a “controlled” document which will be kept as a live document throughout the life cycle of the project. Management will ensure that project personnel and stakeholders access the latest revision of this document. The document will be updated as and when required or whenever there is a change in the Sere Solar PV Project execution strategy. The document will be subjected to both internal and external audits as dictated by the project risk and audit schedule.

## **2.7 RELATED/SUPPORTING DOCUMENTS**

The following supporting documents to be used during the process needs to be developed by the contractor with employers input. Provision needs to be made on each document for both the contractor and the employer representative to sign acceptance.

- [1] Inspection Defects List
- [2] Defect Notification Certificate
- [3] Application for Inspection of the *Works/Part of the Works*
- [4] Safety / House Keeping Certificate
- [5] KKS Certificate
- [6] Partial/Final Inspection Certificate
- [7] Safety Clearance Certificate
- [8] Commissioning Certificate
- [9] Plant Exception Certificate
- [10] Defects Certificate

## **3. COMMISSIONING PROCESS**

### **3.1 General**

#### **3.1.1 Planning and scheduling**

- [1] In order to cover every aspect of commissioning the *Eskom Project Manager* will develop, with inputs from all applicable role players, a Plant matrix referencing the various start-up packages required to commission the Plant.

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- [2] The *Eskom Project Manager* will develop, with inputs from all applicable role players and contractors, the start-up / commissioning schedule and will ensure that it is integrated into the construction schedule. The goal is to define:
- The general order and timing in which the start-up / commissioning activities will take place.
  - The safety pre-requisites and applicable licenses / approvals required for implementing the commissioning procedures.
  - The corresponding manpower, equipment, materials, supplies, and third-party support required to support the start-up / commissioning effort.
  - The manner in which the start-up / commissioning will be managed and executed.
  - The documentation hand-over dates required for each start-up package and dates for each start-up major event.
- [3] The *Contractor* to submit the start-up packages and the construction schedule and start-up / commissioning schedule to the *Employer Project Manager* for approval 12 weeks prior to the execution of the activities.

### **3.1.2 Documentation registration**

All commissioning documentation to have unique numbers for tracking and future references and will be controlled by the *Contractor* until handed over to the *Employer*.

### **3.1.3 Submission and clearance of defects**

- [1] Defects will be classified as follows;
- Priority 1 - System or equipment cannot be operated safely.
  - Priority 2 - must be completed before operational acceptance.
  - Priority 3 - must be completed prior to Client Acceptance.
  - Priority 4 - Cosmetic issues.
  - Priority 5 - Plant Enhancements / Items in Dispute.
- [2] All Defects found during the commissioning period shall be listed by the CWPC on the punch list and copies issued to the *Employer Project Manager*.
- [3] The punch list to form part of the start-up meeting minutes for tracking and reference purposes as well as filed in an available hard copy.
- [4] Where Priority 1 Defects exist the *Contractor* to rectify these Defects and re-apply for an inspection before any further commissioning activities can take place on the applicable system,
- [5] The relevant *Contractor* will notify the *Eskom Project Manager* once Defects have been cleared to arrange for an inspection and signing off of the defect notification.
- [6] The punch list with the Priority 2, 3 or 4 Defects on shall be presented to the *Eskom Project Manager* for his acceptance. Should the list not be acceptable it will be returned

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to the *Contractor* for correction and a resubmission of the Erection Completion Inspection request would be required.

- [7] The safety clearance process can continue only once no Priority 1 Defects exists on the specific plant and the number of Priority 2, 3 and 4 Defects are deemed acceptable by the *Eskom Project Manager*.

## **3.2 CONSTRUCTION**

### **3.2.1 CONTRACTORS PERFORM INSPECTION OF PLANT.**

- [1] The *Contractor* monitors the actual plant construction progress in terms of the:
- Approved construction / commissioning schedule,
  - Sign-off of QCP's,
  - Performance of check & tests including statutory tests such as pressure & loading tests,
  - Sign-off of the data books by the AIA.
- [2] The *Contractor* submits the application for *Contractors Application for Employer Inspection of the Works / Part of the Works*,
- [3] The *Eskom Project Manager* check the request for completion against contractual requirements.
- [4] The *Contractor* ensures that the required drawings and descriptions of the *works* to be inspected are available.
- [5] A pre-inspection of the *works* is carried out by the *Contractor*, *Eskom Project Manager* and *Employer* engineer using the relevant plant check and construction check sheets and approved P&ID's and construction drawings. The plant is checked for completeness, safety and house-keeping aspects, Plant coding and labelling, etc.
- [6] If the *work* conforms to contractual requirements, the *Eskom Project Manager*, *Employer* engineer sign off the *Contractor's* application for the *Employer* Inspection of the Work / Part of the Work and complete the required plant check and construction check sheets.
- [7] If the *work* does not conform to contractual requirements, the *Contractors* application for *Employer* inspection is returned to the *Contractor* with the required endorsements on the application. After rectification of the *works*, the *Contractor* shall reapply for an inspection.
- [8] The *Contractor* schedule the Partial / Final Inspection, energising and commissioning of the Plant system / sub-system and plant items at the start-up meeting. The pre-requisites for the partial /final inspection is the signed-off *Contractor's* application for *Employers* inspection of the Works / Part of the Works form and associated documentation such as P&ID's single line drawings and latest approved design, operating and control philosophy, QCP's and check sheets, applicable alignment checks, cable numbers, cable insulation tests, motor dryness tests, torque checks, calibration certificates, FAT & SAT, statutory load testing certificates, data book completion and AIA release certificates.

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### 3.2.2 PRE-COMMISSIONING REVIEW (PCR)

- [1] The Pre-Commissioning Review is carried out by the *Contractor* with *Employer engineering* performing an oversight and assurance role. Although the final results are required prior to the Partial/Final Inspection the process of confirming equipment conformance already start during construction, fabrication and installation of a system. The review is primarily to ensure compliance with the Design baseline and to ensure the final installed system complies with the detailed Design.

The PCR to verify the following:

- Actual plant/asset configuration conforms to detail Design requirements.
  - The Design documentation set is complete.
  - The system is ready for commissioning by:
    - Reviewing all interfacing services availability for commissioning.
    - Reviewing system commissioning procedures.
    - Confirming all required safety clearances are in place.
    - Verifying Plant codification labelling is as per Design drawings and Works Information.
    - Verifying manuals (e.g., Operating system and Maintenance manuals) are accepted and available.
- [2] The *Contractors* Application for *Employer* Inspection of the Works / Part of the Works will trigger the requirement for the PCR to be conducted for that Plant. For the *Employer* to perform an assurance role the *Contractor* to give at least 5 days' notice and the provision of the PCR Information Packages prior to the date of the inspection. The PCR Information Package consists of at least the following information where applicable:
- All applicable quality records completed during manufacture, FATs, installation, and erection.
  - As-build drawings (Red lined).
  - O&M information (including manuals) relevant to the works/part of the works.
  - Commissioning plan and procedures
  - List of plant modifications.
  - Megger test records.
  - Control circuit test records.
  - Pump alignment records.
  - Hydro test records.
  - Instrument calibration records.
  - Concrete test reports.
  - Compaction test results.
  - Welding records.

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- Signed off inspection and test plans (ITPs).
- Remaining start-up spare parts.
- Full signed data packs.
- The PCR approval certificate is a prerequisite for the Partial / Final Inspection.

### **3.3 START-UP MEETING**

#### **3.3.1 MEETING ARRANGEMENTS**

- [1] The start-up meeting will be conducted as regular as required by the activities on Site.
- [2] The *Eskom Project Manager* appoints a Commissioning Working Party Chairman (CWPC) for each system/sub-system of the Plant.
- [3] The CWPC schedules meetings as and when required to discuss programme, progress and problem areas. The CWPC reports progress at the Start-Up meeting as and when required.
- [4] All Partial / Final Inspections, safety clearances, permit requirements, pre-commissioning and commissioning activities, meetings, plant walk-downs / integrity checks, documentation hand-over and take-over are planned at the start-up meeting.
- [5] The minutes for the commissioning start-up meeting reflect all the commissioning activities as per the Accepted Programme including the;
  - Plant safety permit status (current, new and cleared)
  - Plant status (include impairments)
  - Plant permit plan
- [6] The minutes of the commissioning start-up meeting reflects four periods in time, i.e.:
  - 'A' period – activities reported complete at the previous meeting
  - 'B' period – activities in progress
  - 'C' period – activities planned for the following period to the next start-up meeting
  - 'D' period – activities to be planned in the next three-week window
- [7] The *Eskom Project Manager* or his delegate chairs all start-up meetings for which minutes will be taken and attendance recorded. Copies of the minutes are distributed as per the attendance and distribution list and a copy is stored by the *Eskom Project Manager*.
- [8] Once a week the punch list will be discussed to ensure that all outstanding defects receive the necessary attention to be resolved.

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- [9] All role players involved in commissioning activities shall attend or be represented at the start-up meeting. This includes at least personnel representing:
- *Contractor*,
  - Eskom Project Manager,
  - Commissioning Working Party Members
  - Employer engineering,
  - *Contractor* safety representative,
  - *Contractor* quality representative,
  - Client's Representative.

### **3.3.2 PARTIAL/FINAL INSPECTION**

- [1] After the PCR has been completed successfully and the *Contractors* Application for Eskom Inspection of the Works / Part of the Works approved the Partial / Final Inspection is planned by the *Contractor* at the start-up meeting.
- [2] The appointed CWPC arranges for a physical inspection of the Plant. The inspection team to consist of at least the *Contractor*, Eskom Project Manager, *Employer* engineering, and Client's Representative. The CWPC also receive the signed-off *Contractor's* application for Eskom's inspection of the Works / Part of the Works form and associated documentation as supplied by the *Contractor*.
- [3] Partial Inspection refers to a specific section of Plant where all work is not yet completed but requires energy for Cold Commissioning purposes. e.g., filling, hydro testing, flooding, pressure testing, etc.
- [4] On completion of the inspection, the members conducting the inspection must agree that the Plant conforms to the drawings and standards as specified and is within the scope of the request as submitted by the *Contractor*.
- [5] Rejected Plant inspections follow a remedial path, and the re-planning of the activity follows once the *Contractor* obtains the acceptance of the Eskom Project Manager and the CWPC. A new date is arranged at the Commissioning/Start-Up meeting.
- [6] The *Eskom Project Manager* checks and declares the Plant "as-built" with consent from the CWP.
- [7] For Plant that has been accepted, a Partial/Final Inspection Certificate is completed by the parties who conducted the inspection. This document signifies the Plant is ready for planning of subsequent start-up and commissioning activities.
- [8] The Partial/Final Inspection Certificate with its relevant information, forms the package required for safety clearance and commissioning.
- [9] The *Contractor* will distribute copies of the inspection certificate and confirm that all Defects are corrected.

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### 3.3.3 SAFETY CLEARANCE

- [1] The CWPC prepares the Safety Clearance Certificate. Information for the Safety Clearance Certificate (SCC) is obtained from the Partial/Final Inspection Certificate. The SCC is valid for a specified System/Sub-System of the Plant.
- [2] The CWPC, in consultation with the CWP plans and schedules the safety clearance activities at the start-up meeting.
- [3] On the time and date of the activity, the Working Party members carry out the Safety Clearance Inspection.
- [4] Rejected safety clearances follow a remedial path, as agreed with all parties, and the re-planning of the activity follows. A new date is arranged at the start-up meeting.
- [5] If Safety Clearance is approved. The Eskom Project Manager or person authorised to do so will at this stage apply safety locks as required.
- [6] On acceptance of the safety clearance the *Eskom Project Manager*, *Contractor* safety representative, and discipline *Employer engineer* and *Client Representative* sign the Safety Clearance Certificate to declare the Plant is safe and ready for commissioning.
- [7] The CWPC distributes the Safety Clearance Certificate to the relevant parties as listed on the certificate within 1 working day.
- [8] The Safety Clearance Certificate now becomes part of the hand-over documentation package for the Plant system / sub system or plant item.
- [9] Once a Safety Clearance Certificate is issued, the Plant falls under the Eskom Plant Safety Regulations and / or Operating Regulations for High Voltage Systems, which governs any further work on the Plant to be done under the permit to work system. The *Contractor* remains in control of Plant commissioning activities until take-over. However only Eskom Operators or any person authorised by the Eskom committee may operate the Plant already safety cleared.
- [10] Commissioning of the Plant may now commence, using the required check sheets, commissioning procedures, operating procedures and test results. For Electrical equipment these procedures etc. shall, comply with the requirements of SANS 10142 Part 1.
- [11] The *Contractor* ensure that the “as-build” drawings are available in the project documentation management system. Should there be any modifications during commissioning, a properly marked-up drawing, which reflects the current Plant status, is made available in the project documentation management system.

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### 3.3.4 PLANT LOCK-OUT SYSTEM

#### [1] Locking systems

- **Commissioning lock** - A lock used to prevent unauthorised operating of safety cleared Plant during the commissioning process or when commissioning is temporarily suspended by locking out the energy source to the relevant Plant by the Commissioning Representative for that period.

The Commissioning Lock shall:

- Be a red lock
- Be part of a unique series of locks that is opened by common keys
- Form part of a series that is different from any other series
- Only the *Eskom Project Manager* shall be in possession of these keys
- The *Eskom Project Manager* or his/her delegate will control the keys for the Commissioning Locks

- **Commissioning Safety Lock** – A lock used to lock the boundary points between Safety Cleared systems and non-Safety Cleared systems. These keys are controlled as follows:

- The keys will be put on a Key Safe locked by both an Operating Lock and a Commissioning Lock.
- The Commissioning Safety Lock keys are either removed from the Key Safe once the applicable circuit/Plant have been Safety Cleared and replaced by a Commissioning Lock or under a permit to work.
- For the key to be removed the Appointed Person must remove the Operating Lock from the key safe and the Eskom Representative the Commissioning Lock.
- Where a Commissioning Safety Lock is removed or added to the Key Safe the Appointed Person to note in the Operating log the Commissioning Safety Lock number, reason for lock removal, safety clearance/permit number of circuit/plant and who from commissioning requested the removal/addition.
- Once the relevant Commissioning Safety Locks keys have been removed from the Key Safe, the keys not required to be removed remains on the Key Safe and the Key Safe is locked again with both an Operating Lock and a Commissioning Lock.

The Commissioning Safety Lock shall:

- Be a black lock
- Be marked with an individual number
- Have only a single, unique key available marked with the same number
- Form part of a series that is different from any other series
- Have a key affixed to a key ring in such a manner as to prevent its removal without the use of tools

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- Have ring dimensions such that destruction of the ring is required before it can be removed from a locked Key Safe

If the key to the Commissioning Safety Lock is lost the *Eskom* authorised representative will be in charge of the removal of the Commissioning Safety Lock. This incident shall be recorded in the AO/AP's logbooks.

- **Safety Lock** – A lock used for locking of isolations on Safety Cleared Plant for which a permit to work is required. These keys shall be placed together on one Key Safe. The Key Safe shall than also be locked by an Appointed Person/Appointed Operator with a Safety Lock of which the key is handed to the Responsible Person together with the Work Permit.

The Safety Lock shall:

- Be a small brass lock with a prohibited sticker on
- Be marked with an individual number
- Have only a single, unique key available marked with the same number
- Form part of a series that is different from any other series
- Be affixed to a key ring in such a manner as to prevent its removal without the use of tools
- Have ring dimensions such that destruction of the ring is required before it can be removed from a locked Key Safe

If the key to this lock is lost the Person in charge of plant will oversee the removal of the Safety Lock. This incident shall be recorded in the Appointed Person/Appointed Operator logbooks.

- **Operating Lock** – A lock used by the Appointed Person/Appointed Operator to lock a Key Safe together with a Safety Lock for isolating purposes on Safety Cleared Plant for which a permit to work is required.

The Operating Lock shall:

- Be a blue brass lock
- Be part of a unique series of locks that can be opened by common keys and in possession of Appointed Persons only

## **[2] Applying Commissioning Safety Locks to Non-Commissioned plant**

- **MV Switch gear (11kV and 6.6kV).**

The following process will be followed when safety clearing MV switchgear:

- Ensure that all cable compartment covers are fitted and all bolts are in place. Also ensure that all VT's and CT's are in place where applicable before closing cable compartment covers.
- Remove the breaker from tier and ensure that the breaker and breaker compartment is clean and do a visual inspection on the breaker. Replace breaker and test all function and interlocks, rack in, rack out, test position, cable earth applies on off. With the switchgear in local operate the breaker manually.

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- After the tests are done rack out all breakers and apply the cable earth, then apply safety locks to each of the tiers to prevent the “racking in” of the breaker and the removal of the cable earth.
- The Commissioning Safety Locks will only be removed from the non-commissioned tier if the cable and the electrical consumer are safety cleared and requested by the Eskom Project Manager for a feeder.

- **LV Switch gear (690V, 400V and 220DC).**

The following process will be followed when safety clearing LV switchgear:

- With the flexible disconnected between the bus bars and the transformer, megger the bus bars to ensure that the bus bars are clear of faults. Reconnect the flexible between the bus bars and the transformer and lock transformer housing with Commissioning Safety Locks.
- Test all incomer breakers, rack in, rack out and test position. With the breakers in the local position operate the breaker, open and close. After the test is done rack the incomer breakers out and lock it with a Commissioning Safety Lock in the racked-out position.
- Remove the buckets from the tier. Ensure that the buckets and bucket compartments are clean by doing a visual inspection on the bucket and compartment. Replace the bucket and test all functions, rack in, rack out and test position. With the bucket in the local position operate the bucket, on and off switch.
- After the function checks are done rack out all buckets and apply Commissioning Safety Locks to the buckets to prevent the “racking in” of the bucket.
- The Commissioning Safety Locks will only be removed from the bucket if the cable and the electrical consumer are safety cleared and requested by the Eskom Project Manager for a feeder.

- **Three phase MCBs**

These circuits are locked out as follow:

- Switch all MCBs to the off position and lock with Commissioning Safety Locks.
- The Commissioning Safety Locks will only be removed from the MCB if the cable and the electrical consumer is safety cleared and requested by the Eskom Project Manager for a feeder.

- **Distribution Boards (220V AC), UPSs, and Battery Chargers (220V and 24V DC).**

The following process will be followed when safety clearing a distribution board:

- Switch all MCBs to the off position and lock with Commissioning Safety Locks.
- The Commissioning Safety Locks will only be removed from the MCB if the cable and the electrical consumer are safety cleared and requested by the Eskom Project Manager for a feeder.

- **Mechanical Plant.**

The following process will be followed when safety clearing mechanical plant:

- The Eskom Project Manager will keep a list of equipment that needs to be locked out after the safety clearance.

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- The Eskom Project Manager will tag (sticker) relevant commissioned plant, indicating “Commissioned”, this applies to electrical and mechanical plant systems.

**[3] Removal of Commissioning Safety Locks.**

When *plant*, which is locked with Commissioning Safety Locks, gets safety cleared, the following process will be followed when removing the Commissioning Safety Locks:

- On electrical and instrumentation supplies to the Plant - locks only to be removed when requested by the Eskom Project Manager after he /she has confirmed all related Plant has been safety cleared by all disciplines and the Plant or system is in a state/ safe and ready for commissioning and all construction activities have been completed.
- On electrical feeders / UPS's - locks only to be removed when requested by the Eskom Project Manager after he /she has confirmed all related Plant has been safety cleared by all disciplines and the Plant or system is in a state/ safe and ready for commissioning and all construction activities have been completed.
- On Mechanical Plant – locks only to be removed when the removal is requested by the Eskom Project Manager after he /she has confirmed all related Plant have been safety cleared by all disciplines and the Plant or system is in a state/ safe and ready for commissioning and all construction activities have been completed.

### **3.3.5 COMMISSIONING**

#### **• PRE-COMMISSIONING**

- [1] Following the issuing of the Safety Clearance Certificate the Plant now enters the pre-commissioning phase where it is ascertained that the Plant is ready to be placed in service.
- [2] During the pre-commissioning phase each plant item is checked by the CWP in accordance with the plant pre-commissioning check as provided by the Contractor.
- [3] Having carried out the pre-commissioning check of any plant item, a pre-commissioning check certificate is issued by those parties involved in the check.
- [4] Comments or reservations will be written on the pre-commissioning certificate and be retained as part of the hand-over documentation package for the Plant system / sub system or plant item and kept in the relevant project documentation management system and centre.
- [5] All Plant and equipment that will be affected during commissioning activities will have to be identified and locked out with commissioning locks and tagged with NON – COMMISSIONED labels before energising.
- [6] The requirements of the OHS Act and applicable Regulations as well as Eskom's PSR and ORHVS, as well as the site-specific tagging system must be implemented before energising.

#### **• COMMISSIONING**

- [1] In accordance with the Contract, the *Contractor* compiles and submits a Plant System/Sub-System commissioning procedure for his applicable Plant.

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- [2] All commissioning activities will be performed as outlined in the Commissioning Procedure for the relevant plant.
- [3] The *Contractors* Commissioning Procedure is submitted for review to the *Employer Project Manager* for acceptance. This is done 12 weeks prior to the specific area of Plant to be commissioned.
- [4] Should the Commissioning Procedure be suspended for a prolonged period such as overnight, the CWPC shall secure the plant with a Commissioning Lock for the applicable period.
- [5] Should it be necessary for work to be carried out on the Plant or a sanction for test is required, the Plant shall be isolated and a permit to work used.
- [6] All data needs to be recorded on the commissioning check sheets which will be filed with the hand-over documentation package for the Plant system / sub system or plant item.
- [7] The inventory of all Plant systems / sub systems and plant items as per the approved plant matrix should be used to ensure that no item of plant is overlooked during the commissioning phase. Every Plant system / sub-system should therefore contain a plant item inventory and a detailed commissioning procedure.
- [8] The CWPC shall ensure that the commissioning procedures to be utilised is approved by the Contractor and *Employer* Engineering Manager.
- [9] Commissioning of the Plant commences using the required commissioning procedures, check sheets, operating procedures and test result sheets. For Electrical equipment these procedures shall comply with the applicable requirements such as SANS 10142 Part 1.
- [10] A Commissioning Certificate shall be issued by the CWPC and approved by the Contractor and *Eskom Project Manager* on the completion of the commissioning period.
- [11] A Safety / Housekeeping Certificate shall be issued by the *Contractor* SHEQ department on the Completion of the commissioning period and is required per Plant, unit or common Plant system.

• **OPTIMISATION OF PLANT**

- [1] Once the various systems / sub-systems have been started up individually, the integrated Plant is started up and tuned to optimise performance.
- [2] Where applicable optimisation of Plant shall be carried-out on the different systems / sub-systems making up the unit until proven to meet the requirements of the URS and Plant Design specifications. During this period the Contractor will plan, schedule, execute and report on all activities as per the Accepted Program which includes activities to optimise the plant. Assistance from the *Employer Project Manager* and the Client's Representative, etc will be requested as and when required.
- [3] Capability & Performance Guarantee tests will be performed with the *Contractor*, *Employer* engineering, *Eskom Project Manager* and Client's Representative witnessing

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and documented to demonstrate that each Unit meets the requirements specified in the URS, Design specifications and Grid Code requirements

- **GRID CODE VERIFICATION**

- [1] Grid Code compliance and process to be facilitated by the *Employer* and needs to be incorporated into all stages of the Project. The Accepted Program for the project includes the relevant Grid Code activities.
- [2] The Contractor to form part of the Grid Code Compliance process, provide required information and ensure the Accepted Program make provision for required tests as required for Grid Code compliance.

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#### **4. ACCEPTANCE**

This document has been seen and accepted by:

<b>Name</b>	<b>Designation</b>
Verwey Fourie	GX Peaking Chief Engineer
Antonie Bam	ATKSS Commissioning Snr Advisor
Reggie Chippe	GX Peaking Client office Manager
Isaac Blou	Sere Solar PV Project Manager

#### **5. REVISIONS**

<b>Date</b>	<b>Rev.</b>	<b>Compiler</b>	<b>Remarks</b>
February 2024	0	A.Bam	New procedure developed for Commissioning off EPC contracts

#### **6. DEVELOPMENT TEAM**

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

- Verwey Fourie
- Antonie Bam

#### **7. ACKNOWLEDGEMENTS**

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